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This state curriculum guide is for use by industrial arts personnel in grades seven through 12. It was developed by 15 area groups and two summer workshops in a series of steps including proposed outlines, discussion meetings, content and method listings for each grade, and teaching unit development. The contents are organized by grades under these headings: (1) Manufacturing Industries Grades 7,8, and 9, (2) Manufacturing and Construction Industries Grade 10, (3) Power and Transportation Industries Grade 12. Each section gives general and specific objectives, suggested activities, teacher's approach, and resource materials. Time allotment varies from 2 hours per week in grade 7 to 7 hours per week in grades 11 and 12. The content is designed to expose the average pupil to a wide variety of materials, tools, processes, products, and occupations of modern industry. Supplementary materials include a Suggested Tool and Equipment List for Typical Junior and Senior High School General Shops. (EM)

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A GUIDE FOR
SECONDARY SCHOOLS
IN MAINE

INDUSTRIAL ARTS TECHNOLOGY

A STUDY OF AMERICAN INDUSTRY

State of Maine
Department of Education
Bureau of Vocational Education
Augusta, Maine

INDUSTRIAL ARTS and TECHNOLOGY in MAINE

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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A STUDY OF AMERICAN INDUSTRY

A Guide for Secondary Schools

in MAINE

1965

Department of Education

Vocational Division

Augusta, Maine

Introduction:

Although the responsibility for planning the Industrial Arts curriculum should rest upon the total school staff, it seems desirable that at least a minimum degree of unity should be maintained in all programs in the State. It is the purpose of this guide to establish a curricular framework for the guidance of teachers and administrative personnel of the various schools. These basic suggested units may be used as a point of departure for all programs throughout the State. It is hoped these units will be studied and applied whenever possible to help upgrade industrial arts education in the State of Maine.

William T. Logan, Jr.
Commissioner of Education

Industrial arts in Maine is recognized as general education and serves to provide knowledge and basic skills essential to the understanding of the role of industry in our society. It provides the student with a knowledge of the use of tools necessary to many leisure time activities.

Because of the limited number of vocational education programs in Maine, programs in industrial arts in many secondary schools must do more than provide general education. This program must provide occupational training for a large number of students. This means developing skill in the use of tools and materials used in several occupations, thus giving basic training for a salable skill.

This bulletin describes the objectives of industrial arts and suggests activities to implement them. It should assist school administrators in planning an effective program and serve as a guide for industrial arts teachers.

Philip A. Annas, Director
Division of Instruction

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FOREWORD

Industrial arts, as general education, can make valuable contributions to the development of all students. For this reason, it is desirable that all boys, at least, and girls when possible, have some opportunity to experience industrial arts.

No other subject area in the school can so well promote an understanding of modern industry, its materials and processes, or provide as adequately for the exploration of certain fields of work. When properly taught, industrial arts encourages individual creativeness and results in a genuine appreciation of fine workmanship. And while not intended to prepare the student for employment in any specific occupation, industrial arts should lead to the acquisition of many basic skills and methodical working habits which can be valuable in employment and in everyday life, and which can provide much pleasure and satisfaction in various avocational activities.

If these benefits of industrial arts are to be realized, the total program must be systematically organized with full consideration for the interests and maturity of the students involved. A logical and carefully developed sequence will avoid unnecessary duplication and time wasting.

Much study and many hours of work have gone into the development of this bulletin. It should prove helpful to all teachers of industrial arts. They should be able to adapt it, or portions of it, to their own situation.

Much credit is due Mr. Elwood Padham, who gave leadership to the project, and to the many teachers who participated in the bulletin's development. We commend them all for their interest and dedication to the improvement of industrial arts education in Maine.

John A. Snell, Chief
Bureau of Vocational Education

HOW THIS GUIDE WAS DEVELOPED

In the Spring of 1963, the State Director of Industrial Arts and the Professors of the Industrial Arts Department at Gorham State Teachers College met to discuss the Industrial Arts curriculum for Grades 7 through 12. As a result of this meeting and others, a suggested outline was proposed.

The next step consisted of dividing the State into 15 curriculum groups to discuss the suggested program. The following teachers served as Chairman and Co-Chairman for their particular areas.

Area 1 - Gordon Parritt, Garland St. Jr. H. S., Bangor, Maine

Area 2 - Bruce Trundy, Calais Mem. High School, Calais, Maine

Area 3 - John Jackson, Bucksport High School, Bucksport, Maine

Area 4 - Alden Mitchell, Farmington High School, Farmington, Maine

Area 5 - Robert Bolduc, Madawaska High School, Madawaska, Maine

Area 6 - Richard Grovo, Madison High School, Madison, Maine

Area 7 - Ellery L. Huff, Oxford Hills Senior H. S., Norway-Paris, Maine

Area 8 - Ronald Robertson, Kennebunk H. S., Kennebunk, Maine

Area 9 - Neal Ward, Lincoln Academy, Newcastle, Maine
Dean Bennett, Yarmouth High School, Yarmouth, Maine

Area 10 - Elmer Lyons, Jr., Deering H. S., Portland, Maine
Frederick Jackson, King Jr. H. S., Portland, Maine

Area 11 - Raymond Flagg, Jr., Gardiner Area H. S., Gardiner, Maine

Area 12 - Morton Strom, Camden High School, Camden, Maine

Area 13 - Dennis Mahoney, Schenck High School, E. Millinocket, Maine

Area 14 - George S. Ange, Thornton Academy, Saco, Maine
Alexander Juniewicz, Scarborough H. S., Scarborough, Maine

Area 15 - Kenneth Jordan, Lewiston High School, Lewiston, Maine
Reuben Smith, Montello Jr. H. S., Lewiston, Maine

The following people served as consultants to these groups:

Dr. John Mitchell, Professor and head of the Industrial Arts Department at Gorham State Teachers College

John Greer, Associate Professor of Industrial Arts, Gorham State Teachers College

Arthur Berry, Associate Professor of Industrial Arts, Gorham State Teachers College

John Falls, Assistant Professor of Industrial Arts, Gorham State Teachers College

Elwood A. Padham, State Director of Industrial Arts Education

Many meetings were held across the State, discussing the curriculum materials. In the Spring of 1964, all area Chairmen, Co-Chairmen and consultants met and discussed the suggested sequence industrial arts should follow for Grades 7 through 12. It was decided that suggested content should be listed at each grade level and that various teaching methods implement it. The next step was to develop suggested teaching units for Grades 7 through 12. This was accomplished during two summer workshops; one held in Lewiston and one in Bangor. These were carried out under the direction of Elwood Padham.

The following persons participated in these two workshops:

Lynn W. Markee, Webster Junior High School, Auburn, Maine

Henry Briggs, Brunswick Junior High School, Brunswick, Maine

Carl Gilley, Cape Elizabeth Junior H. S., Cape Elizabeth, Maine

Michael McFadden, Jordan Junior High School, Lewiston, Maine

Reuben Smith, Montello Junior High School, Lewiston, Maine

Lloyd Dunn, Montello Junior High School, Lewiston, Maine

Duane E. Dean, Jack Junior High School, Portland, Maine

Wendell R. McCollor, Lyman Moore Junior High School, Portland, Maine

Robert Lemieux, Westbrook Junior High School, Westbrook, Maine

Paul Boothby, Edward Little High School, Auburn, Maine

Graydon D. Burns, Edward Little High School, Auburn, Maine

Daniel Lowe, Edward Little High School, Auburn, Maine

Henry Thayer, Edward Little High School, Auburn, Maine

Richard Sargent, Edward Little High School, Auburn, Maine

Wayne Stearns, Bridgton High School, Bridgton, Maine

Alfred Dolloff, Cape Elizabeth High School, Cape Elizabeth, Maine

Kenneth Dumais, Jay High School, Jay, Maine

John Buzzell, Lewiston High School, Lewiston, Maine

Kenneth Jordan, Lewiston High School, Lewiston, Maine

Fern Masse, Lewiston High School, Lewiston, Maine

Linwood Allen, Oxford Hills High School, Norway-Paris, Maine

Ellery Huff, Oxford Hills High School, Norway-Paris, Maine

Robert Krach, Stearns High School, Millinocket, Maine

Leslie Lapham, Webster Junior High School, Auburn, Maine

Herbert Giard, Fifth St. Jr. H. S., Bangor, Maine

Gordon Parritt, Garland St. Jr. H. S., Bangor, Maine

G. Vincent Cuozzo, Bangor High School, Bangor, Maine

Charles Maulen, Geo. Stevens Academy, Blue Hill, Maine

Fred Bean, Brewer High School, Brewer, Maine

John Jackson, Bucksport High School, Bucksport, Maine

Robert Tukey, Sumner Memorial High School, Sullivan, Maine

John L. Gatcombe, Mattanawcook Academy, Lincoln, Maine

Robert Lawrence, Orono High School, Orono, Maine

Llewellyn Francis, Searsport High School, Searsport, Maine

Other contributors to this guide:

Dean Bennett, Yarmouth High School, Yarmouth, Maine

William Brazier, Sanford High School, Sanford, Maine

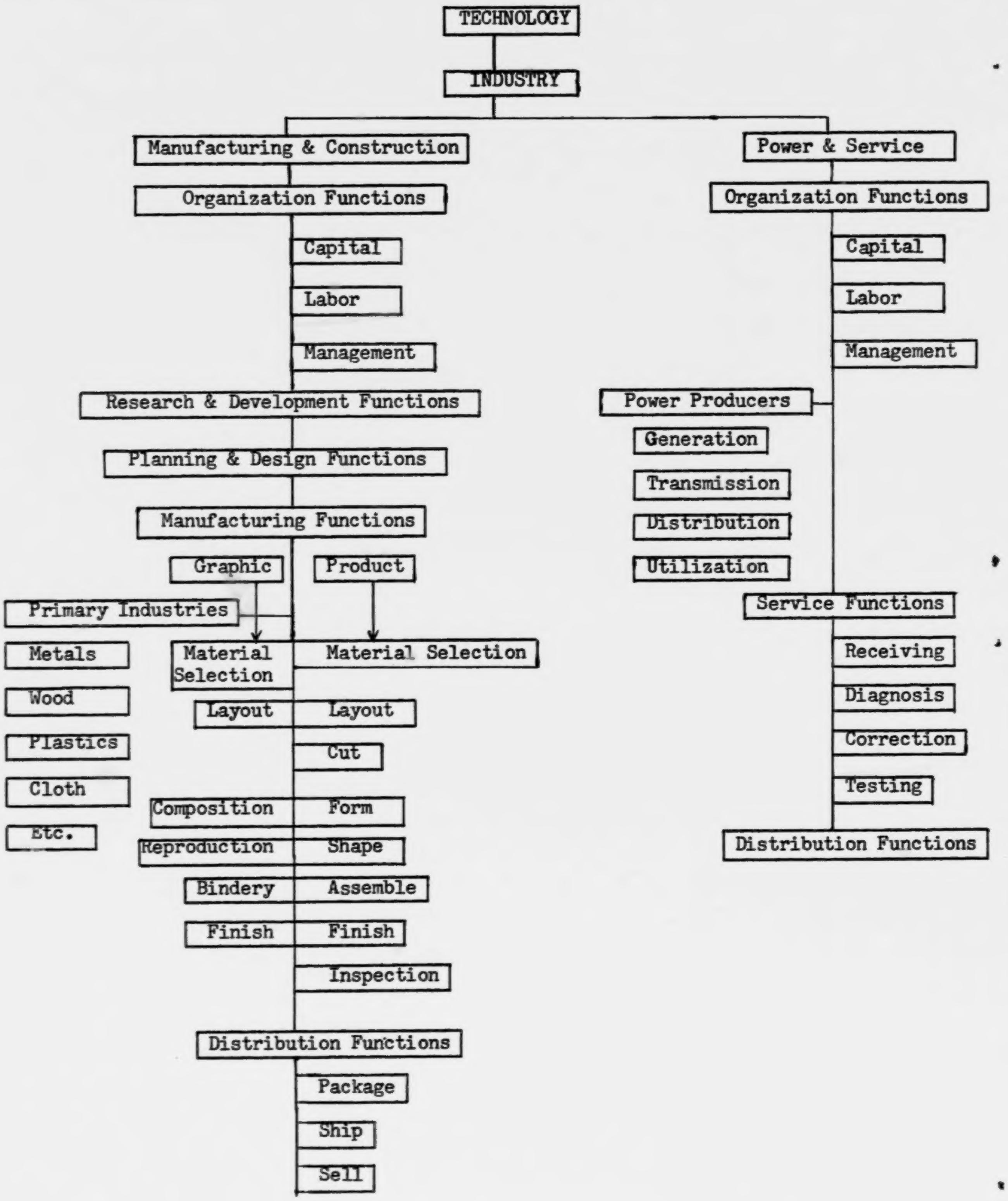
Elmer Lyons, Jr., Deering High School, Portland, Maine

William Findlen, Fort Fairfield High School, Fort Fairfield, Maine

Richard MacGowan, student at Gorham State Teachers College

Many thanks go to Dean Bennett and Dr. John Mitchell for helping edit the material developed in the workshops. Also a special commendation should go to Mrs. Barbara Creamer who typed the complete guide. Thanks must also go to Gorham State Teachers College for the use of its facilities in printing this guide.

Elwood A. Padham, Director
Industrial Arts Education


TECHNOLOGY
INDUSTRY
Manufacturing & Construction
Organization Functions
Capital
Labor
Management
Research & Development Functions
Planning & Design Functions
Manufacturing Functions
Graphic
Product
Primary Industries
Metals
Wood
Plastics
Cloth
Etc.
Material Selection
Layout
Composition
Reproduction
Bindery
Finish
Material Selection
Layout
Cut
Form
Shape
Assemble
Finish
Inspection
Distribution Functions
Package
Ship
Sell
Power & Service
Organization Functions
Capital
Labor
Management
Power Producers
Generation
Transmission
Distribution
Utilization
Service Functions
Receiving
Diagnosis
Correction
Testing
Distribution Functions

Industrial Arts[1]

Industrial arts is that phase of general education which offers individuals an insight into our industrial society through laboratory-classroom experiences. Through the study of industrial arts, the role of industry and technology is unfolded. Students study the history, growth, and development of industrial organizations, materials, products, processes, and related problems. The complexity of the age in which we live is the result of industrial-scientific inventions and innovations. Industrial arts emphasizes problem-solving experiences which assist students in becoming alert contributors and consumers.

Technology and industry continuously influence our way of life. Through industrial arts a learner develops an awareness and appreciation of the tools, materials, and processes involved in the past and present methods of production. It provides experiences in developing basic skills and knowledge common to many occupations and professions. Industrial arts provides a means by which students can apply in practical and meaningful situations the theoretical principles of science, mathematics, and other related subjects.

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[1] Statement of the American Industrial Arts Association (NEA) For the Special Subcommittee on Education of the House Committee on Education and Labor on H. R. 9846, "The National Defense Education Act Amendments, 1964".

Objectives of Industrial Arts

Industrial arts education is designed specifically to help prepare individuals to meet the requirements of an industrial-technological culture. The following four statements of purpose are unique to industrial arts education.

1. TO DEVELOP IN EACH STUDENT AN INSIGHT AND UNDERSTANDING OF INDUSTRY AND ITS PLACE IN OUR SOCIETY. Since industry is a constructive, dynamic force in the world today, it is the responsibility of the school to provide opportunities for each student to understand this force better. Industrial arts provides significant learning experiences relating to industry,in which students acquire skill in performance and knowledge of principles and theory through study and application.

2. TO DISCOVER AND DEVELOP STUDENT TALENTS IN INDUSTRIAL-TECHNICAL FIELDS. Students have a diversity of talents. The school's responsibility is to assist students in discovering and developing these talents. It is the responsibility of industrial arts education to identify special talents in industrial-technical fields.

3. TO DEVELOP PROBLEM-SOLVING ABILITIES RELATED TO THE MATERIALS, PROCESSES, AND PRODUCTS OF INDUSTRY. The problem-solving approach in industrial arts involves creative thinking, and gives the student opportunity to apply principles of planning and design, construction techniques, industrial processes, scientific principles, and mathematical computations to the solution of problems.

4. TO DEVELOP IN EACH STUDENT SKILL IN THE SAFE USE OF TOOLS AND MACHINES. Industrial arts provides planning, construction, and production activities which enable students to acquire industrial-technical skills. These activities offer opportunities to develop tool and machine skills commensurate with the mental and physical maturity of the student.

While these four objectives are considered basic for industrial arts, supplementary objectives may be developed for elementary school, junior high school, high school, and adult programs, as well as special programs for the gifted, the slow learner, and the physically handicapped.

This material was taken from "Industrial Arts Education", published by the American Council of Industrial Arts Supervisors of the American Industrial Arts Association, Inc., A Department of the National Education Association of the United States, 1963.

Industrial Arts to Reflect the Technology[2]

Throughout its evolution, industrial arts has attempted to keep pace with the changing social, economic, and occupational progress of the nation. The rapid technological advances since World War II and the increasing mobility of the population, however, presented a serious challenge to its content and method. New materials, processes, products, and inventions which continue to emerge in man's quest for a longer life and a better standard of living, have given rise to an industrial arts curriculum designed to reflect more effectively the technology. Based upon an analysis of our vast industrial enterprise, this curriculum gives youth the opportunity to learn not only how our industries function, but also, to experience insofar as possible, those activities by which consumer goods and services are produced or provided.

The American industries used for this curriculum may be classified under the following categories: Manufacturing, Construction, Power and Transportation, Electronics, and Services. Research and Management are an integral part of all industries, hence they are not included separately.

A curriculum so oriented defies obsolescence, and, further, its breadth is consistent with the exploratory function of industrial arts as well as the purposes of general education. Obviously, it would be impractical to duplicate all types of industrial activity in the school shop, but certain representative industries can be studied within each of the major classifications, as will be shown later.

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[2] Industrial Arts Department, A Guide to Learning in Industrial Arts, A Preliminary Draft, Gorham, Maine: Gorham State Teachers College, 1960, p. 2.

A Well-Rounded Comprehensive Program of Industrial Arts Education

A well-rounded comprehensive industrial arts program at the secondary school level should include three types of emphases: the *engineering and manufacturing emphasis with research and experimentation* for bright or superior pupils planning to enter college, the *broad industrial arts education with pre-vocational emphasis* for average pupils who may be either ending their education at the completion of high school or going on to vocational or technical schools, and the *specialized industrial arts emphasis including terminal occupational training for the less demanding occupations* for slow learners and the probable early school leavers.

The content in this guide is designed to expose the *average pupil* to a wide variety of materials, tools, processes, products and occupations of modern industry. In the early years of this program, the pupils will receive experiences in the manufacturing, construction, power and transportation, electrical-electronics and service industries. In the final year of the program, pupils will have the opportunity to specialize in one of these industries, with opportunities for advancement toward a chosen goal and occupation.

Organizing the Industrial Arts Program

In order to achieve progression of learning experiences and to encompass the subject matter which this curriculum implies, it is necessary to extend the program over a six-year period as follows:

Grade 7	Manufacturing Industries
Grade 8	Manufacturing Industries
Grade 9	Manufacturing Industries
Grade 10	Manufacturing Industries Construction Industries
Grade 11	Power and Transportation Industries Electrical-Electronics Industries
Grade 12	Service Industries Area of Specialization (vocational orientation)
	or
Grade 12	Areas of Specialization (vocational orientation)

In communities where no industrial arts is offered until the 8th or the 9th grades, the instructor will have to adapt the curriculum to his situation. Similarly, each teacher must select those learning experiences which are suitable to the aptitudes and abilities of his pupils, and the limitations of his facilities and time.

Time Allotment

To fulfill the purposes of the program at each level, sufficient time should be allocated not only for the instructional activities but also for getting out materials, tools, and products at the beginning of the period, and for putting these away, washing up, and restoring the shop to order at the close of the period. Double periods, for this reason, are more ideally suited and should be provided whenever possible. Single periods, either separately or as part of a double period, may be devoted to research, planning, designing, reading, discussion, writing, reporting, or the like, which are a necessary part of the program.

The minimum weekly time allotments for each grade level, based on one semester of work for grades 7 and 8 and two semesters of work for grades 9 through 12 should be:

Grade 7	4 periods or 2 periods	18 weeks 36 weeks	160-220 minutes 80-110 minutes
Grade 8	4 periods or 2 periods	18 weeks 36 weeks	160-220 minutes 80-110 minutes
Grade 9	5 periods	(2 double and 1 single)	200-275 minutes
Grade 10	5 periods	(2 double and 1 single)	200-275 minutes
Grade 11	7 periods	(2 double and three single) (or) (3 double and one single)	280-up
Grade 12	7 periods	(2 double and three single) (or) (3 double and one single)	280-up

Equipment and Facilities

A suggested equipment list for the junior high school and senior high school can be found in the Appendix. The equipment list was determined by analyzing the learning experiences to be offered in industrial arts from grades seven through twelve. The facilities needed to carry on the industrial arts program at the junior high school and senior high school will be found in another bulletin. The number and sizes of industrial arts facilities will be determined by the scope and breadth of the program, the nature of the learning experiences, the number of students to be served by the program, the willingness and ability of the community to provide the necessary financial support and the space requirements needed around each piece of equipment to operate it safely.

Implementing the Program

A variety of teaching methods and techniques may be used to teach the content of the industrial arts program. In this guide you will find teaching units from grade seven through twelve. These are suggested units; other units may be substituted as long as they are consistent with the industry that is studied at that grade level. The following suggested units may be considered, after which adaptations or modifications may be made to meet local requirements.

GRADE VII

	Manufacturing Industries	Suggested time
Suggested Units:	Technology and Civilization	1 week
	Household Accessories	8 - 9 weeks
	Personal Accessories	8 - 9 weeks

GRADE VIII

	Manufacturing Industries	
Suggested Units:	Camping Equipment	6 - 9 weeks
	Hunting and Fishing Equipment	5 - 7 weeks
	Communication Equipment	5 - 8 weeks

GRADE IX

Manufacturing Industries

		Suggested time
Suggested Units:	Tools and Home Workship Equipment	9 weeks
	Small Furniture for the Home	10 weeks
	Production Industries (Mass Production)	9 weeks
	Model Power Products	8 weeks

GRADE X

Manufacturing and Construction Industries

Suggested Units:	Tool and Machine Industries	12-15 weeks
	Residential Construction	18-20 weeks
	Transportation Construction	3-4 weeks

GRADE XI

Power and Transportation Industries
Electrical-Electronics Industries

Suggested Units:	Thermal Power	
	a. Portable Power Plant Industries	6-9 weeks
	b. Transportation by Automobile	6-9 weeks
	Residential Wiring	3-6 weeks
	Wire and Wireless Communication	12-18 weeks

GRADE XII

Service Industries

Suggested Units:	Small Service Business Management	2 weeks
	Appliance Servicing	7-11 weeks
	Automotive Servicing	6-9 weeks
	Repair and Refinishing Industries	3-5 weeks
	Area of Specialization (vocational orientation) (The student may choose 18 weeks in any of the following industries: Manufacturing, Construction, Power and Transportation, Electrical-Electronics or Service)	18 weeks

(Optional)
GRADE XII

Suggested Units:	Area of Specialization (vocational orientation) (The student may choose 36 weeks in any of the following industries: Manufacturing, Construction, Power and Transportation, Electrical-Electronics or Service)	36 weeks

Manufacturing
Industries
Grade 7

Industrial Arts $\frac{8}{9}$

Title of Unit: Technology and Civilization

Introduction:

This unit is designed to orient the junior high pupil to the industrial arts program, the meaning and purpose of industrial arts and the proper use of the industrial arts facilities. It is a guide introducing the pupil to the evolution of American technology and the significance and meaning of industry.

Scope:

a. 7th grade

b. 1 week

Objectives

1. To develop in each pupil an understanding of the meaning and purpose of industrial arts and the organization of the industrial arts program.

2. To develop in each pupil a basic knowledge and understanding of American industry and technology, particularly its evolution and purpose or importance.

3. To develop in each pupil an appreciation and understanding of the purpose for the proper use of and proper conduct in the industrial arts laboratory facilities.

Objective: 1. To develop in each pupil an understanding of the meaning and purpose of industrial arts and the organization of the industrial arts program.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a knowledge of the meaning, purpose and objectives of industrial arts.	a. Lesson - The meaning, purpose and objectives of industrial arts.
2. He will have an understanding of industrial arts and its relationship to himself and to industry and technology.	a. Reading Assignment.
3. He will understand how the program is organized in the school he is attending, and his role in it.	a. Lesson - Role of the Pupil in Implementing the Organized Industrial Arts Program. May include the following: 1. How to get most out of Industrial Arts. 2. Personnel system. 3. Grading system. 4. Extra work. 5. Attendance and make-up. 6. Aprons. 7. Discipline. 8. Texts and references.
4. He will realize the importance of safety awareness and will follow safety rules in all situations.	a. Discussion - Safety in the industrial arts laboratory. b. Lesson - Organization of the safety program. May include the following: 1. Safety engineer. 2. Safety bulletin board. 3. Safety checksheet. 4. Safety rules & suggestions in all lessons. 5. Safety posters and charts by machines. 6. School insurance. 7. Safety tests. 8. Goggles by machines. 9. Safety guards. 10. Safe organization of facilities. 11. Proper ventilation. 12. Accident report forms.

Objective: 2. To develop in each pupil a basic knowledge and understanding of American industry and technology, particularly its evolution and purpose or importance.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will understand the purpose and importance of American industry and technology.	a. Research Assignment - The meaning of the term, "TECHNOLOGY". b. Discussion - The purpose and importance of industry and technology.
2. He will have a knowledge of the general stages of development in the evolution of American industry and why they occurred.	a. Reading Assignment - Information sheet. b. Discussion - Reasons for the development of American industry and technology.

Objective: 3. To develop in each pupil an appreciation and understanding of the purpose for, the proper use of and proper conduct in the industrial arts laboratory facilities.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will appreciate and realize the importance of a well planned and equipped industrial arts facility.	a. Discuss planning of facilities - show plans, etc.; mention cost, bring out purpose.
	b. Tour of the facilities.
2. He will have an understanding of how to use the industrial arts facilities.	a. Lesson - How to use the industrial arts facilities. May include the following: 1. Checking out tools. 2. Procuring materials. 3. Use of scrap material. 4. General care of tools, machines and materials. 5. Safety procedures.
3. He will respect the work and materials of others as well as his own.	a. Provide proper storage for products the pupils are working on.
	b. Require care in the handling of materials, tools and equipment.
4. He will work harmoniously with class members.	a. Set up policies for pupils in relation to tool use and shop facilities.
	b. Use group or class projects.
	c. Relate to industry, the personnel organization and team work.
5. He will use time effectively.	a. Plan work to utilize time and equipment available.
	b. Discuss the importance of time and the use of efficiency experts by industry.
6. He will conduct himself in a manner insuring his own safety and that of his classmates.	a. Discuss importance of safe conduct.

Approach:

Use careful planning in starting the class for the first time.

Resource Material:

Olson, Delmar W. Industrial Arts and Technology. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963.

Olson, Delmar W. Industrial Arts for the General Shop. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1961.

Schneider, Eugene V. Industrial Sociology. New York: McGraw-Hill Book Company, Inc., 1957.

Title of Unit: Manufacture of Household Accessories (A study of a manufacturing industry)

Introduction:

Industry today has changed a great deal since the time when our forefathers were in school. It is important that industrial arts keep up with and reflect this change in its program.

With many millions of men and women gainfully employed by industries producing household accessories and since the importance of these products is easily recognized by beginning pupils who are generally familiar with them, this seems an appropriate area in which to begin a study of the manufacturing industries.

Through the production of a household accessory, the pupil will better understand the industry and become a better consumer for the industry.

Scope:

a. 7th grade

b. 8 - 9 weeks (suggested)

Objectives

1. To develop in each pupil an insight into and understanding of the household accessory industry, its place in our society and its elements in common with the manufacturing industry as a whole.

2. To develop in each pupil worthy leisure-time interests and encourage creative expression.

3. To develop in each pupil problem-solving abilities related to the materials, processes, and products of the household accessory manufacturing industry.

4. To develop in each pupil a degree of skill in the safe use of tools and machines needed to produce a household accessory product.

Objective: 1. To develop in each pupil an insight into and understanding of the household accessory industry, its place in our society and its elements in common with the manufacturing industry as a whole.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will be aware of the scope of the household accessory industry as compared to the manufacturing industry as a whole.	a. Assignment - list household accessory products.
	b. Research assignment on selected household accessories in the State.
	c. Bulletin board display - "The Household Accessory Industry".
	d. Class discussion - "The importance of the household accessory industry in the field of manufacturing".
2. He will be aware of the nature and types of occupations in the household accessory industry.	a. Assigned readings on various occupations.
	b. Films.
	c. Class discussion - "Occupational Requirements".
3. He will know the responsibility of the following occupations: personnel, purchasing, inspection, engineering, production control, and industrial engineering.	a. Study or make personnel chart.
	b. Speaker from industry.
	c. A short outside assignment on each subject.
4. He will know what is meant by mass production in industry.	a. Written assignment on mass production.

Objective: 2. To develop in each pupil worthy leisure-time interests and encourage creative expression.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will be able to locate and use sources of information pertaining to leisure-time interests developed through the study of the household accessory industry.	a. Assignment - Find out sources of information that are available in the school library.
2. He will share information about his hobbies.	a. Assignment - Written report on a hobby interest.
	b. Pupil that is interested may display work he has done in his hobby.
3. He will have a desire to use creative expression in the development of a product.	a. Submit a number of sketches showing how a selected article may be improved.
	b. Create a sketch of an article which will fulfill a need or an interest.

Objective: 3. To develop in each pupil problem-solving abilities related to the materials, processes, and products of the household accessory manufacturing industry.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will apply principles of design to manufactured products.	a. Discuss, show and demonstrate design principles applied to manufactured products.
2. He will follow a logical procedure in selecting a product.	a. Relate procedures used by industry in selecting product to manufacture to those used in industrial arts laboratory.
	b. Show pupil sources of ideas in catalogs, books, and magazines.
	c. Have pupil visit gift shops, hardware and sporting goods stores, and others for ideas.
	d. Have pupil select a product to make using procedures outlined.
3. He will make working sketches or drawings of selected household accessories.	a. Show pupil sketches or drawings obtained from industry.
	b. Introduce pupil to basic sketching and drawing procedures.
	c. Have pupil sketch or draw article selected.
4. He will analyze drawing or sketches for materials needed.	a. Have pupil examine drawings or sketches for duplicate parts, sizes, fasteners, finishes, etc.
	b. Show method of recording materials on stock list.
	c. Show specimen stock lists used in industry.
	d. Discuss function of stock list.

Objective: 3. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
5. He will analyze drawing or sketch for procedures and/or construction details.	a. Have pupil complete a job or project plan for article selected.
	b. Discuss steps or procedures taken in fabrication of product and why each should fall in a logical pattern.
	c. Show specimen article and have pupil analyze it for procedure and/or construction.
6. He will recognize and/or obtain materials selected.	a. Show and discuss characteristics of different materials.
	b. Have pupil examine storage racks and distinguish between materials.
	c. Have pupil measure and cut out stock.
	d. Have pupil check off stock list and label parts as they are obtained. Record sizes, if different.
7. He will know how industry packages its products.	a. Class discussion over packaging in industry.
	b. Submit a plan for packaging product produced.
8. He will understand how industry determines price of its product.	a. Outside reading assignment on cost production, labor cost and mark up.
	b. Speaker from industry.
	c. Class discussion.
	d. Set a price on product produced.

Objective: 3. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
9. He will understand how industry distributes its product.	a. Study transportation problems. b. Speaker from industry. c. Show films on distribution.
10. He will inspect and evaluate the finished product accurately.	a. Class discussion over quality and craftsmanship. b. Pupil evaluation of product produced.

Objective: 4. To develop in each pupil a degree of skill in the safe use of tools and machines needed to produce a household accessory product.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use simple layout tools and procedures.	a. Lessons over those layout tools needed for the construction of the product.
	b. Have pupil locate and name the layout tools he will use.
	c. Show film ABC of Hand Tools (General Motors)
	d. Have pupil measure to within a 1/16". (stress accuracy).
2. He will recognize and use simple cutting tools and procedures.	a. Lessons over those cutting tools needed for the construction of the product.
	b. Have pupil locate and name the cutting tools he will use.
3. He will recognize and use simple shaping and forming tools and procedures.	a. Lessons over those shaping and forming tools needed for the construction of the product.
	b. Have pupil locate and name the shaping and forming tools he will use.
4. He will recognize and use simple holding tools and procedures.	a. Lessons over those holding tools needed for the construction of the product.
	b. Have pupil locate and name the holding tools he will use.
5. He will recognize and use simple assembly tools and procedures.	a. Lesson over those assembly tools needed in the construction of the product.
	b. Have pupil locate and name the assembly tools he will use.

Objectives: 4. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. He will recognize and use simple finishing equipment and procedures.	a. Lesson over the finishing equipment needed in the construction of the product. b. Have pupil locate and name the assembly tools he will use.
7. He will select and use machines and procedures.	a. Lessons over machines needed in the construction of the product. b. Have pupil demonstrate safe operation of machines.

Suggested Texts:

Olson, Delmar W. *Industrial Arts for the General Shop*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1961.

Resource Materials:

Boyd, T. Gardner. *Metalworking*. Chicago, Ill.: The Goodheart-Willcox Co., Inc., 1961.

Cherry, Raymond. *General Leathercraft*. Bloomington, Ill.: McKnight & McKnight Publishing Co., 1946.

Cherry, Raymond. *General Plastic*. Bloomington, Ill.: McKnight & McKnight Publishing Co., 1952.

Cope, Dwight. *Cope's Plastic Book*. Chicago, Ill.: The Goodheart-Willcox Co., 1960.

Dunham, Arthur. *Working with Plastic*. New York: McGraw-Hill Book Co., 1948.

Feirer, John L. *Woodworking for Industry*. Peoria, Ill.: Chas. A. Bennett Co., Inc., 1963.

Groneman, Chris H., *Plastic Made Practical*. Milwaukee, Wisconsin: Bruce Pub. Co., 1948.

Lockrey, A.J. *Plastic in the School and Home Work Shop*. Princeton, N.J.: D. Van Nostrand Co., 1946.

Mansperges, Dale E., and Pepper, Carson W. *Plastic Problems and Processes*. Scranton: International Textbook Co., 1939.

Mudden, Ira C., *Woodworking for Industrial Arts*. Chicago, Ill.: The Goodheart-Willcox Co., Inc.

Shea, John C., and Wenger, Paul N. *Woodworking for Everybody*. Scranton: International Textbook Co., 1944.

Siegner, C. Vernon. *Art Metals*. Chicago, Ill.: The Goodheart-Willcox Co., Inc., 1961.

Zanco, Manley Lawrence, *General Shop Projects*. Bloomington, Ill.: McKnight & McKnight Publishing Co., 1960.

Tools and Equipment:

Tools and equipment needed will be those found in a typical junior high school general shop. (See Appendix)

Approach:

1. Display a variety of household accessories for the pupils to examine.

2. Discuss how industry might design and produce some of these accessories, and different materials that might be used in their production.

3. Sponsor a field trip such as a visit to a department store where household accessories are on display.

4. Sponsor a visit to an industrial plant where household accessories are manufactured.

5. Sponsor a class discussion as to what each individual pupil could use in his home or camp as a household accessory.

Activities:

1. Have pupils select and design a household accessory after discussing with them procedures which industry goes through and comparing them with those in the shop. Include limitations of the shop facilities, materials, pupil abilities, time, cost, learning experiences.

2. Have pupils develop drawings of the article selected.

3. Have pupils complete a materials list. Use procedures common to industry. Show materials catalogs and how suppliers list their products.

4. Develop with the pupils the principles of analyzing a sketch or drawing for details of construction and procedure. Stress logical sequence in construction activities.

5. Have pupils fabricate the article according to plan developed. Demonstrate the tool and machine processes involved, stress safety, principles involved, care for tools and machines and cooperation and regard for others.

6. Inspect and test article made, according to function, workmanship, marketability, and determine cost or probable selling price.

7. Optional - operate a mass production project and produce household accessories.

8. Optional - study a primary industry that produces materials that are used in the manufacture of household accessories.

Suggested Texts:

Bauer, Carlton E. and Thompson, Robert L. Comprehensive General Shop I. Milwaukee, Wisconsin: The Bruce Publishing Company, 1962.

Groneman, Chris H. and Feirer, John L. General Shop. New York: McGraw-Hill Book Company, Inc. 1963.

Miller, John. Comprehensive General Shop II. Milwaukee, Wisconsin: The Bruce Publishing Company, 1962.

Suggested Texts:

Olson, Delmar W. Industrial Arts for the General Shop. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1961.

Resource Materials:

Boyd, T. Gardner. Metalworking. Chicago, Ill.: The Goodheart-Willcox Co., Inc., 1961.

Cherry, Raymond. General Leathercraft. Bloomington, Ill.: McKnight & McKnight Publishing Co., 1946.

Cherry, Raymond. General Plastic. Bloomington, Ill.: McKnight & McKnight Publishing Co., 1952.

Cope, Dwight. Cope's Plastic Book. Chicago, Ill.: The Goodheart-Willcox Co., 1960.

Dunham, Arthur. Working with Plastic. New York: McGraw-Hill Book Co., 1948.

Feirer, John L. Woodworking for Industry. Peoria, Ill.: Chas. A. Bennett Co., Inc., 1963.

Groneman, Chris H., Plastic Made Practical. Milwaukee, Wisconsin: Bruce Pub. Co., 1948.

Lockrey, A.J. Plastic in the School and Home Work Shop. Princeton, N.J.: D. Van Nostrand Co., 1946.

Mansperges, Dale E., and Pepper, Carson W. Plastic Problems and Processes. Scranton: International Textbook Co., 1939.

Mudden, Ira C., Woodworking for Industrial Arts. Chicago, Ill.: The Goodheart-Willcox Co., Inc.

Shea, John C., and Wenger, Paul N. Woodworking for Everybody. Scranton: International Textbook Co., 1944.

Siegner, C. Vernon. Art Metals. Chicago, Ill.: The Goodheart-Willcox Co., Inc., 1961.

Zanco, Manley Lawrence, General Shop Projects. Bloomington, Ill.: McKnight & McKnight Publishing Co., 1960.

Tools and Equipment:

Tools and equipment needed will be those found in a typical junior high school general shop. (See Appendix)

Materials & Supplies:

Pine; Cedar; Hardboard; Plywood; Veneer; Thermoplastics (Lucite, Plexiglass, Vinyl); Thermosetting (Castolite, Bakelite, Formica); Calfskin; Steerhide; Nails; Brads, Abrasive paper; Glues; Water stain; Solvents; Paint; Shellac; Wipe on finishes; Wax; Acetone; Ethylene dichloride; Rouge; Garnet finishing paper; Dyes; Flexible lacquer.

Lessons to be Taught:

Manipulative lessons:

This list of lessons was taken from the analysis of objectives.

Since the use of a variety of materials is encouraged but may not be practical in every instance, it would be more logical for manipulative lessons to be selected by the individual teacher to follow the general engineering and manufacturing procedures used by industry to produce its products rather than by categories such as woodworking, metalworking, etc.

Manipulative lessons then would fall into the following categories:

1. Engineering
    - Design
    - Sketching
    - Drawing
    - Materials list
    - Procedure of manufacture

2. Manufacture

    The following tool groupings are concerned only with those tools needed in the production of household accessories. Listing of specific tools that may be used can be found in the appendix.

    a. Layout tools and procedures
    Lessons should include:
        (1) Recognizing and selecting
        (2) Correct naming
        (3) Using properly and safely (To the extent needed in the manufacture of the product)

    b. Cutting tools and procedures
    Lessons should include:
        (1) Recognizing and selecting
        (2) Correct naming
        (3) Using properly and safely (To the extent needed in the manufacture of the product)

    c. Shaping and forming tools and procedures
    Lessons should include:
        (1) Recognizing and selecting
        (2) Correct naming
        (3) Using properly and safely (To the extent needed in the manufacture of the product)

Lessons to be Taught:

Manipulative lessons: (continued)

d. Holding tools and procedures
Lessons should include:
  (1) Recognizing and selecting
  (2) Correct naming
  (3) Using properly and safely (To the extent needed in the manufacture of the product)

e. Assembly tools and procedures
Lessons should include:
  (1) Recognizing and selecting
  (2) Correct naming
  (3) Using properly and safely (To the extent needed in the manufacture of the product)

f. Finishing equipment and procedures
Lessons should include:
  (1) Recognizing and selecting
  (2) Correct naming
  (3) Using properly and safely (To the extent needed in the manufacture of the product)

g. Machines and procedures
Include lessons over those machines needed to manufacture the product.

Related Lessons:

This list is taken from the analysis of objectives and is in the nature of general statements of information to be taught rather than in specific titles. It should be noted that this list does not include films, discussions, and other teaching methods suggested to achieve the behavior changes.

1. Principles of design
2. Selecting a product
3. Packaging in industry
4. Quality and craftsmanship

Teaching Aids or Devices: (Suggested Ideas)

1. ABC of Tools. (Film, General Motors).
2. Use of Instruction Sheets.
3. Display Board of wood, plastics and leather.
4. Model display.
5. Books with projects to make.
6. Charts from Industry.
7. Instructional materials from Industry.
8. Field trips.
9. Jigs and Mock-ups.
10. Speakers from Industry.

Evaluation Techniques:

1. Observation.
2. Oral report.
3. Class discussions.
4. Written test.
5. The project itself.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavioral changes listed in the analysis of the objectives have been accomplished.

Title of Unit: Manufacture of Personal Accessories (A study of the Handicraft Manufacturing Industry)

Introduction:

The manufacture of personal accessories as an industry is developing into one of considerable size, both in production and capital outlay. This growth stems from the desire of man to enrich his society, his surroundings and his own appearance. It also is due in part to the tremendous "gift-giving" habit of the American people.

These industries are often managed and organized by a single individual who produces an item and sells it himself in his own shop or for re-sale in some other gift or knick-knack shop. There are also large plants which specialize in the production of all sorts of trinkets and devices in the personal accessories line. The items can be made from numerous types of materials such as woods, plastics, metals, cloth, leather, paper and numerous types of synthetics. Designs may vary from the very simple to the more complex mechanical ones.

The attitudes and drives of the seventh grade pupil make the investigation of this type of industry an ideal starting place in the continuing study of the manufacturing industries. Most boys of this level will be highly interested in the production of an item for personal use or as a gift to some close friend or relative. Through this keen desire on their part it will be possible to develop basic understandings and appreciations concerning the manufacturing industries.

Scope:

a. 7th grade

b. 8 - 9 weeks (suggested)

Objectives

1. To develop in each pupil an active interest in and understanding of the handicraft manufacturing industry and its place in our society.

2. To develop in each pupil worthy leisure-time interests and to encourage creative expression.

3. To develop in each pupil problem-solving abilities as they relate to the materials, processes and products, such as personal accessories, that are manufactured by the handicraft manufacturing industry.

4. To develop in each pupil a degree of skill in the safe use of common tools and machines found in the manufacture of personal accessories.

Objective: 1. To develop in each pupil an active interest in and understanding of the handicraft manufacturing industry and its place in our society.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will realize the vastness and scope of the handicraft manufacturing industry.	a. Assign readings in magazines, catalogues and other resource materials to become familiar with the different kinds of handicrafts. b. Research paper on the selected handicraft industries in the state. c. Bulletin board display - " The handicraft manufacturing industry" d. Discussion on the importance of the handicraft manufacturing industry in the field of manufacturing.
2. He will become aware of the various occupations within the handicraft manufacturing industry.	a. Assign readings on the various occupations in this industry. b. Use motion pictures to show the job requirements of various occupations in the handicraft manufacturing industry.

Objective: 2. To develop in each pupil worthy leisure-time interests and to encourage creative expression.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will be able to locate and use sources of information pertaining to leisure-time interests developed through the study of the handicraft manufacturing industry.	a. Assignment - have pupil find out what sources of information are available in the school library.
2. He will share information about his hobbies.	a. Written reports on the different hobbies carried on by the pupil. b. Have pupil that is interested display work done in his hobby.
3. He will have a desire to use creative expression in the development of a product.	a. Submit a variety of sketches on how the design and style of a personal accessory could be improved. b. Create a design and sketch of a personal accessory that will fulfill a need or an interest.

Objective: 3. To develop in each pupil problem-solving abilities as they relate to the materials, processes and products, such as personal accessories, that are manufactured by the handicraft manufacturing industry.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will apply principles of design to a personal accessory.	a. Discuss, show and demonstrate design principles applied to manufactured products. b. Bulletin board display - "Design factors"
2. He will follow a logical procedure in selecting a personal accessory.	a. Relate procedure used by industry in selecting product to manufacture to those used in the industrial arts laboratory. b. Show pupil sources of ideas in catalogues, books and magazines. c. Have pupil visit gift shops for different ideas. d. Have pupil select an article to produce using procedure outlined.
3. He will make sketches or drawings of a personal accessory.	a. Show pupil sketches or drawings obtained from industry. b. Review with pupil sketching and drawing procedures. c. Have pupil sketch or draw article selected.
4. He will analyze drawings or sketches for materials needed.	a. Have pupil examine drawings or sketches for duplicate parts, sizes, fasteners, finishes, etc. b. Show pupil method of recording materials on materials list. c. Show pupil specimen stock list used by industry. d. Discuss the function of a materials list. e. Have pupil complete a materials list.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
5. He will analyze drawings or sketches for procedures and/or construction details.	a. Discuss steps or procedures taken in fabrication of product and why each should follow a logical pattern.
	b. Have pupil complete a job or project plan for article selected.
	c. Show specimen article and have pupil analyze it for procedure and/or construction.
6. He will recognize and/or obtain materials selected.	a. Show and discuss characteristics of different materials.
	b. Have pupil examine storage rack and distinguish between materials.
	c. Have pupil measure and cut out stock.
	d. Have pupil check off stock list and label parts as they are obtained.
7. He will inspect and evaluate the finished product accurately.	a. Class discussion over quality and craftsmanship.
	b. Have pupil evaluate product produced.
8. He will know how industry packages its products.	a. Class discussion over packaging in industry.
	b. Have pupil submit a plan on how he would package his own product.
9. He will know how industry prices and distributes its products.	a. Class discussion over pricing and distribution of products.

Objective: 4. To develop in each pupil a degree of skill in the safe use of common tools and machines found in the manufacture of personal accessories.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use layout, cutting, forming, holding, shaping, assembly and finishing tools and procedures.	a. Lessons over layout, cutting, forming, shaping, holding, assembly and finishing tools needed in the construction of product. b. Have pupil locate and name the layout, cutting, forming, holding, shaping, assembly and finishing tools he will use.
2. He will select and use machines and procedures.	a. Lessons over machines needed in the construction of the product. b. Have pupil demonstrate safe operation of machines he will use.

Approach:

1. Display a variety of handicraft products for the pupils to examine.
2. Sponsor a field trip such as a visit to a gift shop where personal accessories are on display.
3. Conduct a class discussion as to what each pupil could use as a personal accessory.

Activities:

1. Have pupils select and design a personal accessory after discussing with them the procedures which industry goes through and comparing them with those in the shop. Include limitations of the shop facilities, materials, pupil abilities, time, cost and learning experiences.
2. Have pupils develop sketches or drawings of the article selected.
3. Have pupils complete a materials list. Use procedures common to industry. Show materials catalogs and how suppliers list their products.
4. Develop with the pupils the principles of analyzing a sketch or drawing for details of construction and procedure. Stress logical sequence in construction activities.
5. Have pupils fabricate the article according to plan developed. Demonstrate the tool and machine processes involved, stress safety, principles involved, care for tools and machines and cooperation and regard for others.
6. Have pupils inspect and test article made, according to function, workmanship, marketability and determine cost or probable selling price.
7. Optional - operate a mass production project and produce personal accessories.
8. Optional - study a primary industry that produces materials that are used in the manufacture of personal accessories.

Suggested Texts:

Bamer, Carlton E. Comprehensive General Shop I. Milwaukee: Bruce Publishing Company, 1962.

Groneman, Chris H. and Feirer, John L. General Shop. New York: McGraw-Hill Book Company, Inc., 1963.

Miller, John. Comprehensive General Shop II. Milwaukee: Bruce Publishing Company, 1962.

Olson, Delmar W. Industrial Arts for the General Shop. Englewood Cliffs: Prentice-Hall, Inc., 1961.

Resource Material:

American Handicrafts Co. *Basic Basketry*. Fort Worth: Tandy Leather Co., 1964.

Bick, Alexander F. *Plastics for Fun*. Milwaukee: Bruce Publishing Co., 1954.

Cherry, Raymond. *General Leathercraft*. Bloomington: McKnight & McKnight Publishing Co., 1955.

Gottshall, Franklin H. & Hellum, Amanda Watkins. *You Can Whittle and Carve.* Milwaukee: Bruce Publishing Co., 1956.

Groneman, Chris H. *Leathercraft*. Peoria: Chas. A. Bennett Co., Inc., 1958.

Quinn, Jeffery E. *Braiding and Lacing for Fun*. Fort Worth: American Handicrafts Co., 1962.

Seeley, Vernon D. & Thompson, Robert L. *Activities in Ceramics*, Bloomington: McKnight & McKnight Publishing Co., 1956.

Stohlman, A. *How to Carve Leather*. Fort Worth: Tandy Leather Co., Inc.

Zimmerman, Fred W. *Leathercraft*. Chicago: Goodheart-Willcox Co., Inc., 1961.

Tools and Equipment:

Tools and equipment needed will be those found in a typical junior high school general shop. (See Appendix)

Materials and Supplies:

Billfold blanks; Belt strips; Sides (4-5 oz.); Skivers; Cement; Edge dressing; Cleaner; Dye; Finish coat; Neatsfoot oil; Calf lacing; Saddle soap; Assorted woods; Mountings; Plastic spray; Lacquer; Reed; Plywood weaving bases (various shapes); Raffia needles; Grout and sealer; Clay; Glazes; Stilts (assorted sizes); Pyrometric cones; Sheet tin; Solder; Flux; Sal ammoniac; Carbon paper; Paint and finishing materials; Steel wool; Abrasives; Liver of sulphur; Jewelry findings; Felt cloth; Jewelry's saw blades; Alcohol; Glues; Escutcheon pins; Raffia; String; Hong Kong grass; Tile; Tile-kit trays; Plastic bags; Oilcloth; Sandpaper; Enamel colors; Copper blanks & hardware; Marble particles; Pyro lace (various colors); Bracelet blanks; Snaps; Metal brite; Wiping cloths; Lacing needles; Swivel hooks; Plastic materials.

Lessons to be Taught:

This list of lessons was taken from the analysis of objectives.

Since the use of a variety of materials is encouraged but may not be practical in every instance, it would be more logical for manipulative lessons to be selected by the individual teacher to follow the general engineering and

Lessons to be Taught: (cont.)

manufacturing procedures used by industry to produce its products rather than by categories such as woodworking, metalworking, etc.

Manipulative lessons then will fall into the following categories.

1. Engineering
    - Design
    - Sketching
    - Drawing
    - Materials list
    - Procedure of manufacture

2. Manufacture
    (Concerned only with those tools needed in production of personal accessories, Listing of tools found in the Appendix)

    a. Layout, cutting, forming, shaping, holding, assembly and finishing tools and procedures should include
        (1) Recognize and select
        (2) Name correctly
        (3) Use properly and safely (To extent needed in manufacture of product)

    b. Machines and procedures should include
        (1) Name correctly
        (2) Use properly and safely (To extent needed in manufacture of product)

It should be noted that this list does not include films, discussions and other teaching methods suggested to achieve the behavior changes.

Related Lessons

This list of lessons was taken from the analysis of objectives and is in the nature of general statements of information needed to be taught rather than specific titles.

1. The importance of the Handicraft Manufacturing Industry in the field of manufacturing.
2. Job requirements in the Handicraft Manufacturing Industry.
3. Principles of design.
4. Logical procedures used by industry in selecting a product to produce.
5. Sketching and drawing a personal accessory.
6. Showing and discussing characteristics of different materials used in the manufacture of a personal accessory.
7. Inspecting and evaluating a finished product.
8. Packaging procedures used by industry.
9. How industry prices and distributes a finished product.

Teaching Aids or Devices: (Suggested Ideas)

Films:

Braiding and Lacing (15 min.)
Copper Enameling (15 min.)
Copper Tooling and Manufacturing (29 min.)
Mosaics (17 min.)
Beginner's Leathercraft (13½ min.)
From: American Handicraft Co., Fort Worth, Texas.

Film Strip:
Introduction to Basic Leather (Color with sound) Tandy Leather Co.

Instruction sheets:
"Braid-O-Bracelet" the Rex Corporation, Haywood Road, W. Acton, Mass.
"Copper Enameling Process"
"Mosaics Process"
From: American Handicraft Co., Fort Worth, Texas.
"Mosaics and Mos-Aids instruction booklets" Pacific Arts and Crafts.
PO Box 2101, Inglewood, California.

Charts:
Craft tool lacing chart, Tandy Leather Co.

Patterns:
Assorted Metal tooling design pads and booklets, American Handicrafts Co.

Evaluation Techniques:

During the period of time which this unit will encompass, occasional tests and quizzes will be given. They will include the various techniques and methods listed below. There will be a final exam at the end of the unit.

Techniques:

1. Performance tests.
2. Completion questions.
3. Multiple choice questions.
4. Recall items.
5. Tool identification tests.
6. Self-evaluation sheets.
7. Teacher observation.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavioral changes listed in the analysis of the objectives have been accomplished.

Manufacturing
Industries
Grade 8

Title of Unit: Manufacture of Camping Equipment (A study of a manufacturing industry)

Introduction:

If you are one of those independent souls whose eyes are always on distant horizons and whose feet itch for far places, then this story is for you - for it is about that magic carpet for campers - lightweight camping equipment! Not fancy equipment - not gadgets that only a rich man can buy but streamlined stuff that you yourself can make.

There is scarcely a person - child or adult - who has not been attracted by some piece of camping equipment. The industries which manufacture these products employ a large percentage of both men and women. Throughout the year and especially in the summer months, the high volume of these products is evident in shopping centers everywhere to meet the increasing consumer demands.

The nature of the early adolescent makes him particularly responsive to activities within the realm of his interest. This unit provides an interesting theme for the study of a manufacturing industry.

Scope:

a. 8th grade

b. 6 - 9 weeks (suggested)

Objectives

1. To develop in each pupil an understanding of the camping equipment industries and the role they play in our culture.

2. To discover and develop in each pupil talents in industrial-technical fields related to manufacturing industries producing camping equipment.

3. To develop in each pupil, through the use of problem-solving activities, an understanding of the processes, materials, and equipment involved in the development and manufacture of camping equipment.

4. To develop in each pupil a degree of skill in the safe use of tools and machines needed to manufacture a piece of camping equipment in the industrial arts laboratory.

Objective: 1. To develop in each pupil an understanding of the camping equipment industries and the role they play in our culture.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know the industries involved in camping equipment.	a. Have pupil investigate the industries involved with camping equipment.
	b. Bring in samples of products produced by these industries.
	c. Have pupil discuss these products for possible laboratory construction.
2. He will realize the place this industry plays in our society.	a. Discuss leisure-time activities, shorter work week, delinquency.
	b. Discuss financial contribution of this industry to our economic wealth.
3. He will realize the effect of seasons on this industry.	a. List seasons and compare types of activities for each.
4. He will recognize the necessity of research in industry.	a. Discuss how research has brought about changes in camping equipment.
	b. Encourage pupil to read magazines to learn of new ideas brought about by research.

Objective: 2. To discover and develop in each pupil talents in industrial-technical fields related to manufacturing industries producing camping equipment.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will be aware of the following typical occupations and positions found in a manufacturing company and how they relate to the camping equipment industry: sales, design engineering, methods engineering, tool design, cost accounting, materials control, purchasing, production control, personnel, production, maintenance, quality control and finance.	a. Lesson over typical manufacturing occupations.
2. He will understand the nature of work and responsibility of a position of his choice in the production of a piece of camping equipment.	a. Choose a position in a camping equipment company and write a report on work the position entails as applied to the production of a camping equipment product being produced.
3. He will have an understanding of requirements and considerations applicable to occupational opportunities in the industry.	a. Explanation by school guidance counselor on factors to consider in occupational placement.

Objective: 3. To develop in each pupil, through the use of problem-solving activities, an understanding of the processes, materials, and equipment involved in the development and manufacture of camping equipment.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will apply principles of good design to camping equipment.	a. Lesson: design and principles. b. Discuss and evaluate equipment brought in as to design and function.
2. He will use proper procedure in product selection.	a. Compare Industry's method of project selection to Industrial Arts. b. Show pupils locations for product lines. c. Have pupils select a product.
3. He will make sketches or drawings of product selected.	a. Show pupils sample sketches or blue prints. b. Introduce pupils to sketching and drawing. c. Have pupils draw product.
4. He will analyze sketches or drawings for material list.	a. Show pupils stock lists from industry. b. Have pupils study drawings for number of items, fasteners, and finish. c. Discuss and explain need for stock list. d. Show pupils proper procedure for making stock list.
5. He will analyze product for methods of construction.	a. Have pupils complete a plan of procedure for product.

Objective: 3. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. He will recognize and obtain materials needed.	a. Show and discuss materials available. b. Show location of materials in shop and catalogs. c. Have pupils study and list major materials used by the camping equipment industries.
7. He will select and use simple finishing materials and techniques.	a. Give pupils research assignment on kinds of finishes used. b. Discuss types of finishes, its advantages and industrial application. c. Demonstrate methods of applying finishes and relate to industry. d. Have pupils select and apply finish.
8. He will inspect product using proper testing procedures.	a. Lesson: industrial inspection and why it is needed. b. Inspect product using shop tools. c. Discuss industrial and school quality standards. d. Have pupils use a product evaluation form to inspect and evaluate their product.
9. He will analyze cost of product to determine value.	a. Figure cost of product using material, labor, overhead, and margin of profit. b. Have pupils discuss market value of product and relate to industry.
10. He will have a knowledge of packaging in industry.	a. Design packaging method for camping product being produced. b. Discuss packaging methods.

Objective: 3. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
11. He will have a knowledge of distribution methods used by the camping equipment industry.	a. Lesson: Distribution of manufactured products.

Objective: 4. To develop in each pupil a degree of skill in the safe use of tools and machines needed to manufacture a piece of camping equipment in the industrial arts laboratory.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use layout tools and procedures.	a. Explain names and uses of layout tools in the shop. b. Discuss layout tools used by industry. c. Have pupils layout stock or transfer designs. Stress accuracy.
2. He will recognize and use holding tools and procedures.	a. Explain names and use of holding tools in the shop. b. Discuss holding tools used by industry. c. Have pupils utilize holding tools whenever needed in construction of product.
3. He will recognize and use cutting tools and procedures.	a. Explain names and uses of cutting tools in the shop. b. Discuss special cutting tools used by industry. c. Have pupils cut out stock.
4. He will recognize and use forming and shaping tools and procedures.	a. Explain names and uses of forming and shaping tools in the shop. b. Discuss special tools used by industry. c. Have pupils use forming and shaping tools as needed on their product.
5. He will recognize and use assembly tools and procedures.	a. Explain names and uses of simple assembly tools. b. Discuss special tools used by industry. c. Have pupils use assembly tools as needed.

Objective: 4. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. He will have a knowledge of and use safely with a degree of skill those machines needed to produce his product.	a. Lessons over machines needed to produce products. b. Discuss functions of machines in industry. c. Pupils will use machines as needed. d. Have pupils use safety check list.

Approach:

1. Set up bulletin board displays showing camping scenes which will stimulate interest and motivate constructive thinking.
2. Show films of camping activities and discuss possible useful articles which could provide comfort and convenience on a trip.
3. Provide a display of simple camping equipment.
4. Give examples of various magazines, brochures, and catalogues where camping equipment may be observed.
5. Discuss, with the students, possible articles of camping equipment which could be constructed or modified.
6. Discuss how industry approaches the problems of design, manufacture, shipping, cost breakdown, consumer reaction, etc.
7. Include in the discussion the importance of industrial arts and its relationship to our modern day industrial society.
8. Tour the shop and show the tools and equipment available and pertinent to this unit.

Activities:

1. Have pupils select and design a piece of camping equipment after discussing with them procedures which industry goes through and comparing them with those in the shop. Include limitations of the shop facilities, materials, pupil abilities, time, cost, learning experiences.
2. Have pupils develop drawings of the article selected.
3. Have pupils complete a materials list. Use procedures common to industry. Show materials catalogs and how suppliers list their products.
4. Develop with the pupils the principles of analyzing a sketch or drawing for details of construction and procedure. Stress logical sequence in construction activities.
5. Have pupils fabricate the article according to plan developed. Demonstrate the tool and machine processes involved, stress safety, principles involved, care for tools and machines and cooperation and regard for others.
6. Inspect and test article made, according to function, workmanship, marketability, and determine cost or probable selling price.
7. Optional - operate a mass production project and produce camping equipment.
8. Optional - study a primary industry that produces materials that are used in the manufacture of camping equipment.

Suggested Texts:

Bauer, Carlton E. and Thompson, Robert L. Comprehensive General Shop I. Milwaukee, Wisconsin: The Bruce Publishing Company, 1962.

Groneman, Chris H. and Feirer, John L. General Shop. New York: McGraw-Hill Book Company, Inc., 1963.

Miller, John. Comprehensive General Shop II. Milwaukee, Wisconsin: The Bruce Publishing Company, 1962.

Olson, Delmar W. Industrial Arts for the General Shop. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1961.

Resource Materials:

Fryklund, Verne C. General Shop Woodworking. Bloomington, Ill.: McKnight & McKnight Publishing Company, 1963.

Feirer, John L. Industrial Arts Woodworking. Peoria, Ill.: Chas. A. Bennett Co., Inc., 1960.

Willoughby, George A. and Chamberlain, Duane G. General Shop Handbook. Peoria, Ill.: Chas. A. Bennett Co., Inc., 1958.

Feirer, John L. General Metals. New York: McGraw-Hill Book Company, Inc., 1959.

Bruce, Leroy F. Sheet Metal Shop Practice. Chicago, Ill.: American Technical Society, 1959.

Cherry, Raymond. General Leathercraft, Bloomington, Ill.: McKnight & McKnight Publishing Company, 1955.

Cherry, Raymond. General Plastics - Projects and Procedures. Bloomington, Ill.: McKnight & McKnight Publishing Company, 1948.

Tools and Equipment:

Tools and equipment needed will be those found in a typical junior high school general shop. (See appendix)

Materials and Supplies:

Various gauges of sheet metal (Tin Plate, Galvanized iron, Copper, Nickel, Silver); Various thicknesses and colors of flat plastic; a variety of wood (hard and soft) possibly some plywood; assorted bolts, rivets and screws; solder and soldering flux; Emery cloth, steel wool and sandpaper; an assortment of leather; various widths of 1/8" bandiron; finishing materials (paint, acids, etc.); brushes.

Lessons to be Taught:

Manipulative Lessons:

This list of lessons was taken from the analysis of objectives.

Since the use of a variety of materials is encouraged but may not be practical in every instance, it would be more logical for manipulative lessons to be selected by the individual teacher to follow the general engineering and manufacturing procedures used by industries to produce its products rather than by categories such as woodworking, metalworking, etc.

Manipulative lessons would then fall into the following categories.

1. Engineering
   - Design
   - Sketching
   - Drawing
   - Materials list
   - Procedure of manufacture

2. Manufacture

   The following tool groupings are concerned only with those tools needed in the production of camping equipment. Listing of specific tools that may be used can be found in the appendix.

   a. Layout tools and procedures
      Lessons should include:
      (1) Recognizing and selecting
      (2) Correct naming
      (3) Using properly and safely (To the extent needed in the manufacture of the product)

   b. Holding tools and procedures
      Lessons should include:
      (1) Recognizing and selecting
      (2) Correct naming
      (3) Using properly and safely (To the extent needed in the manufacture of the product)

   c. Cutting tools and processes
      Lessons should include:
      (1) Recognizing and selecting
      (2) Correct naming
      (3) Using properly and safely (To the extent needed in the manufacture of the product)

   d. Forming and shaping tools and procedures
      Lessons should include:
      (1) Recognizing and selecting
      (2) Correct naming
      (3) Using properly and safely (To the extent needed in the manufacture of the product)

Manipulative Lessons: (continued)

e. Assembly Tools and Procedures
   Lessons should include:
   (1) Recognizing and selecting
   (2) Correct naming
   (3) Using properly and safely (To the extent needed in the manufacture of the product)

f. Machines needed to produce the product

g. Finishing materials and methods

Related Lessons:

This list is taken from the analysis of objectives and is in the nature of general information to be taught rather than in specific titles.

It should be noted that this list does not include films, discussions, and other teaching methods suggested to achieve the behavior changes.

1. Typical manufacturing occupations.
2. Design and principles.
3. Industrial inspection and why it is needed.
4. Distribution of manufactured products.

Teaching Aids or Devices: (Suggested Ideas)

1. Chalkboard.
2. Charts relative to: Safety, materials list, plan sheets, line and staff organization.
3. The types of lines, a blueprint of a working drawing, a sample product.
4. Any assignment sheets pertaining to coverage of material pertinent to unit. Ex. (finishes, layout tools, soldering, etc.).

Evaluation Techniques:

1. Observe students as lessons are taught and as they work.
   a. Are they interested.
   b. Do they work safely.
   c. Are they solving their own problems.
   d. Are they quality conscious.
   e. Are they showing improvement.
   f. Are they wasteful and destructive of materials.
   g. Do they understand the overall reason they are in the lab. Its significance with industry.

2. Question and answer period.
   a. How much do they participate.
   b. Are they accurate with their answers.
   c. Are their questions thought provoking and pertinent.

3. Could give a research paper and evaluate for content and pertinent data.

4. Written tests and quizzes.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavioral changes listed in the analysis of the objectives have been accomplished.

Title of Unit: Manufacture of Hunting and Fishing Equipment (A study of a manufacturing industry)

Introduction:

Maine points with pride to its reputation of being one of the finest vacationlands in our country. For many years we have sought to tell our fellow Americans what a fine state we have for recreation. The many beautiful woods and waters of our state have made this a veritable paradise for hunters and fishermen who come to enjoy their favorite pastime. Because of this, many industries associated with the manufacture of hunting and fishing equipment are located within our state. It has become one of our leading businesses with many of our fellow "Maniacs" making a fine living from these industries.

Because the production of hunting and fishing equipment is such a vital part of the economy of our state we have prepared a unit to acquaint the teenage boy with the manufacture of hunting and fishing equipment. It seems only fitting that part of the formal education of these young sportsmen should include a study to familiarize them with the technical end of the industry, the job opportunities in this field, and to encourage their participation in these wholesome activities during leisure hours.

Scope:

a. 8th grade

b. 5 - 7 weeks (suggested)

Objectives

1. To develop in each pupil an insight into and understanding of the hunting and fishing equipment industries.

2. To discover and develop pupil talents by using tryout experiences in the industrial-technical fields of the hunting and fishing equipment industries.

3. To develop in each pupil problem-solving abilities related to the materials, processes and products of the hunting and fishing equipment industries.

4. To develop in each pupil the safe use of tools and machines found in the manufacture of hunting and fishing equipment.

Objective: 1. **To develop in each pupil an insight into and understanding of the hunting and fishing equipment industries.**

Expected pupil behavioral change	Suggested activities to implement the change
1. He will be familiar with industries that manufacture hunting and fishing equipment.	**a. Have pupil investigate the industries through reading assignments.**
	b. Invite experts in several hunting and fishing equipment industries to discuss their product with the pupils.
2. He will realize the economic importance of the hunting and fishing equipment industries to the state of Maine.	**a. Have pupil make a report on economic importance of the hunting and fishing equipment industries by contacting the Department of Economic Development and the Inland Fisheries and Game Department.**
3. He will know the importance of the year-round hunting and fishing equipment industry.	**a. Discuss the importance of the various seasons in the hunting and fishing industry.**
	b. Invite a game warden and camp operator to give a talk on this topic.
4. He will know the effects of seasons on the hunting and fishing equipment industry.	**a. List seasons and compare types of activities of each.** **(1) September - archery** **(2) October - November - hunting** **(3) December - March - ice fishing** **(4) April - September - fishing** **(5) Ice out - September 30 lake fishing**

Objective: 2. To discover and develop pupil talents by using try-out experiences in the industrial-technical fields of the hunting and fishing equipment industries.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know that salesmen sell the product to be produced or forecast the number which can be sold in the ensuing production period.	a. Discuss with the class the requirements for entering the sales field. b. Have pupil prepare a guidance folder covering the sales field in a manufacturing industry.
2. He will know that the design engineers create the style and physical structure of the product in the form of blueprints or specifications.	a. Discuss with the class the requirements for entering the design engineering field. b. Lesson on how new products are developed by this department.
3. He will know that the industrial engineers draw up bills of materials and operation and route sheets to govern the procedures in the manufacture of the product.	a. Have pupil report on the job requirements for industrial engineers. b. Discuss with pupil the routing of parts and plant layout.
4. He will know that cost accounting keeps track of the cost of production and makes extensive reports to line management concerning the economy of "in process" activities.	a. Discuss with the class the requirements for entering the cost accounting field. b. Have pupil write a research paper on duties of a cost accounting department.
5. He will know that materials control notifies production control concerning the availability of materials for specific orders that have been established on the operation and route sheets by the system engineers.	a. Have pupil report on the job requirements for the materials control field. b. Discussion on how materials are controlled and stored.

Objective: 2. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. He will know that the purchasing department goes out into the field and secures the best possible price on materials.	a. Have pupil prepare an assignment covering the job requirements of a purchaser in a manufacturing concern. b. Have speaker from purchasing department of a local manufacturing concern.
7. He will know that the personnel department is constantly supplying and maintaining a qualified, happy work force so production will not be held up for the lack of personnel.	a. Have pupil report on the job requirements of a personnel department in a manufacturing concern. b. Have pupil make out an application for employment.
8. He will know that the production control department receives the blueprints and the order and route sheets and issues orders at the right moment so that production can begin when designated.	a. Have pupil prepare a guidance folder covering the production control department of a manufacturing company.
9. He will know the general nature of the production jobs and the various requirements.	a. Discuss with the class the various occupations that are represented in the production of a piece of hunting and fishing equipment.
10. He will know that the maintenance men will keep the machines in top running order so that breakdowns will not impede production.	a. Have pupil report on the job requirement for maintenance man in a manufacturing concern.
11. He will know that the inspectors in the quality control department are comparing actual performance with standards.	a. Discuss with the class the requirements for inspectors in a manufacturing industry.
12. He will know that the financial division of a company should review all transactions which have financial aspects so to keep the company in good financial standing.	a. Have pupil prepare an assignment covering the job requirements of the financial division in a manufacturing concern.

Objective: 3. To develop in each pupil problem-solving abilities related to the materials, processes and products of the hunting and fishing equipment industries.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will apply principles of good design to a piece of hunting or fishing equipment.	a. Lesson on principles of design (review) b. Have pupil design or re-design a piece of hunting or fishing equipment.
2. He will make sketches or drawings of selected product.	a. Review with pupil sketching and drawing procedures. b. Have pupil sketch or draw a piece of hunting or fishing equipment.
3. He will analyze the sketches or drawings for materials list.	a. Have pupil complete a materials list for a piece of hunting or fishing equipment.
4. He will analyze product for methods of construction.	a. Discuss the importance of following a logical procedure when manufacturing a product. b. Have pupil complete a procedure sheet for the article selected.
5. He will recognize the material selected for the article.	a. Lesson on characteristics of different materials. b. Have pupil get out materials for article to be constructed.
6. He will inspect and evaluate the finished product.	a. Class discussion over inspection and quality control. b. Have pupil evaluate the product produced.
7. He will know how industry packages its products.	a. Lesson on packaging methods used by industry. b. Have pupil submit a plan on how he would package his own product.

Objective: 3. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
8. He will know how industry prices and distributes its products.	a. Lesson on pricing and distributing of products.

Objective: 4. To develop in each pupil the safe use of tools and machines found in the manufacture of hunting and fishing equipment.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use layout tools and procedures.	a. Lessons over layout tools needed in the construction of the product. b. Have pupil locate and name the layout tools he will use.
2. He will recognize and use cutting tools and procedures.	a. Lessons over cutting tools needed in the construction of the product. b. Have pupil locate and name the cutting tools he will use.
3. He will recognize and use forming and shaping tools and procedures.	a. Lessons over forming and shaping tools needed in the construction of the product. b. Have pupil locate and name the forming and shaping tools he will use.
4. He will recognize and use holding tools and procedures.	a. Lessons over holding tools needed in the construction of the product. b. Have pupil locate and name the holding tools he will use.
5. He will recognize and use assembly tools and procedures.	a. Lessons over assembly tools needed in the construction of the product. b. Have pupil locate and name the assembly tools he will use.
6. He will recognize and use finishing tools and procedures.	a. Lessons over finishing tools needed in the construction of the product. b. Have pupil locate and name the finishing tools he will use.

Objective: 4. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
7. He will select and use machines and procedures.	a. Lessons over machines needed in the construction of the product. b. Have pupil demonstrate safe operation of machines he will use.
8. He will care for tools, equipment and facilities.	a. Have pupil return tools to proper panels as soon as he finishes using them. b. Show pupil simple maintenance procedures on tools and equipment used.

Approach:

1. Arrange field trips to local allied industries and retail salesrooms.

2. Discuss what we could learn about the hunting and fishing industries, including a discussion of possible products we could produce in our own shop.

3. Outside reading, including sports magazines such as Field and Stream, Sportsman's Bible, Sports Afield, Open Road for Boys, Sports, catalogues, brochures, pamphlets, etc. available from various sporting goods companies.

4. Films showing products being manufactured such as:
   a. Industry on Parade, print No. 165, manufacturing of cameras.
   b. Industry on Parade, print No. 203, Boat manufacturing.
   c. Industry on Parade, print No. 290, Fool proof fish rods.
   d. Quality Castings, I.A. No. 629, G. S. T. C.

5. Demonstration by students of various products pertaining to the hunting and fishing equipment industries such as rods, reels, bait cans, bailers, flys, rifles, etc.

6. Display of various posters around the room such as ballistics charts available from Winchester of Remington Arms, drawings of fish, deer and game, charts of fishing laws, etc., to help motivate interest in the unit.

Activities:

1. Have pupils select and design a piece of hunting and fishing equipment after discussing with them procedures which industry goes through and comparing them with those in the shop. Include limitations of the shop facilities, materials, pupil abilities, time, cost, learning experiences.

2. Have pupils develop drawings of the article selected.

3. Have pupils complete a materials list. Use procedures common to industry. Show materials catalogs and how suppliers list their products.

4. Develop with the pupils the principles of analyzing a sketch or drawing for details of construction and procedure. Stress logical sequence in construction activities.

5. Have pupils fabricate the article according to plan developed. Demonstrate the tool and machine processes involved, stress safety, principles involved, care for tools and machines and cooperation and regard for others.

6. Inspect and test article made, according to function, workmanship, marketability, and determine cost or probable selling price.

7. Optional - operate a mass production project and produce hunting and fishing equipment.

8. Optional - Study a primary industry that produces materials that are used in the manufacture of hunting and fishing equipment.

Suggested Texts:

Bauer, Carlton E. *Comprehensive General Shop I.* Milwaukee 1, Wisconsin: Bruce Publishing Co., 1962.

Groneman, Chris H. and Feirer, John L. *General Shop.* New York: McGraw-Hill Book Company, Inc., 1963.

Miller, John. *Comprehensive General Shop II.* Milwaukee 1, Wisconsin: Bruce Publishing Company, 1962.

Olson, Delmar W. *Industrial Arts for the General Shop.* Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1961.

Resource Materials:

Dragoo, A. W. and Reed, Howard O. *General Shop Metalwork.* Bloomington, Illinois: McKnight and McKnight, Publishers, 1947.

Edwards, Lauton. *Industrial Arts Plastics.* Peoria, Illinois: Chas. A. Bennett Co., Inc., 1964.

Feirer, John L. *General Metals.* New York: McGraw-Hill Book Company, Inc., 1959.

Fryklund, Verne C. and LaBerge, Armand J. *General Shop Bench Woodworking.* Bloomington, Illinois: McKnight and McKnight, Publishers, 1955.

Ludwig, Earl A. *Metalwork-Technology and Practice.* Bloomington, Illinois: McKnight and McKnight, Publishers, 1962.

Zimmerman, Fred W. *Leathercraft.* Chicago, Illinois: The Goodheart-Willcox Co., Inc., 1961.

Tools and Equipment:

Tools and equipment needed will be those found in a typical junior high school general shop (See Appendix).

Materials and Supplies:

Leather dye; neatsfoot oil; leather wax dressing; assorted antique finish; screw posts; rapid rivets; key frames; belt buckles; assorted leathers; rawhide; rivets; snap fastener sets; dot snap fasteners; cage dot snap fastener; duco cement; edge enamel; saddle soap, flux, solder, salammoniac; assorted band iron; cold roll steel; copper, aluminum rod; aluminum sheet; galvanize iron; black iron; tin plate; embossed metal; brass rod; sheet brass; boil; oil can-lube cutting oil; plexiglas sheets; acrylic rods; plastic cement; plastic polish; ethylene dichloride glue; ciba dyes; tenite; casting plastic; metal findings for plastic; trans-plastic sheets.

Lessons to be Taught:

This list of lessons was taken from the analysis of objectives.

Since the use of a variety of materials is encouraged but may not be practical in every instance, it would be more logical for manipulative lessons to be selected by the individual teacher to follow the general engineering and manufacturing procedures used by industry to produce its products rather than by categories such as woodworking, metalworking, etc.

Manipulative lessons then will fall into the following categories.

1. Engineering
    - Design
    - Sketching
    - Drawing
    - Materials list
    - Procedure of manufacture

2. Manufacture
    (Concerned only with those tools needed in production of hunting and fishing equipment. Listing of tools found in the Appendix)

    a. Layout tools and procedure should include
        (1) Recognize and select
        (2) Name correctly
        (3) Use properly and safely (To extent needed in manufacture of product)

    b. Cutting tools and procedures should include
        (1) Recognize and select
        (2) Name correctly
        (3) Use properly and safely (To extent needed in manufacture of product)

    c. Forming and shaping tools and procedures should include
        (1) Recognize and select
        (2) Name correctly
        (3) Use properly and safely (To extent needed in manufacture of product)

    d. Holding tools and procedures should include
        (1) Recognize and select
        (2) Name correctly
        (3) Use properly and safely (To extent needed in manufacture of product)

    e. Assembly tools and procedures should include
        (1) Recognize and select
        (2) Name correctly
        (3) Use properly and safely (To extent needed in manufacture of product)

f. Finishing tools and procedures should include
    (1) Recognize and select
    (2) Name correctly
    (3) Use properly and safely (To extent needed in manufacture of product)

g. Machines and procedures should include
    (1) Name correctly
    (2) Use properly and safely (To extent needed in manufacture of product)

Related Lessons

This list of lessons was taken from the analysis of objectives and is in the nature of general statements of information needed to be taught rather than specific titles.

It should be noted that this list does not include films, discussions, and other teaching methods suggested to achieve behavior changes.

1. The importance of the Hunting and Fishing Equipment Industry in the field of manufacturing.

2. Job requirements in the following occupations: sales, design engineering, industrial engineering, cost accounting, materials control, purchasing, personnel, production control, production, maintenance, inspection and finance.

3. Principles of design.

4. Sketching and drawing a piece of hunting and fishing equipment.

5. Characteristics of the various materials used in the manufacture of a piece of hunting and fishing equipment.

6. Inspecting and evaluating a finished product.

7. Packaging procedures used by industry.

8. How industry prices and distributes a finished product.

Teaching Aids or Devices: (Suggested Ideas)

Diagram of bait box and finished product.
Diagram of rifle and scope and cutaway of each.
Diagram of boat heater in poster form.
Poster of bailing pump in operation and diagram for building it.
Cutaway diagram of reel showing metal and plastic gears and its function.
Poster of archer hunting showing diagram and construction of archer's glove and quiver, and also construction of bow and arrow.
A. Stoeger's Shooter's Bible (available from sporting goods dealers $2.50)

Teaching Aids or Devices: (continued)

Design and construction of fish rod handles which could be turned from aluminum, plastic or wood. Personal designed handles that a pattern may be made of wood and cast in foundry.

Collapsible boat seat which would be designed of band iron and welded and assembled with a leather back.

Ballistics charts available from Winchester of Remington Arms.

Diagram of cutaway outboard motors available from Johnson Motor Co.

Also charts showing proper lubrication and care of Johnson Motors.

Completed fishing flies or lures on display.

A large wall map of Maine showing towns that have hunting or fishing equipment industries.

Evaluation Techniques:

The following evaluation techniques are suggested for use in this unit. The instructor should include material that is covered in his particular class.

1. Evaluate pupil attitude and industriousness as he is doing his work.
2. Offer a brief quiz as the need arises.
3. Evaluate each pupil as to his fulfilling course requirements.
4. Use reports and require written assignments on the material in the unit.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavior changes listed in the analysis of the objectives have been accomplished.

Title of Unit: Manufacture of Communication Equipment (A study of a Manufacturing Industry)

Introduction:

Anyone who wishes to feel at home in the world of modern technology must be familiar with the fundamentals of electricity. To make it possible to acquire this familiarity quickly and easily is the purpose of presenting the following information in this unit and centering it around the theme of "Communication Equipment Found in the Home and Industry".

As recently as 100 years ago little was known about the nature and behavior of electricity to say nothing of its present value and importance. Only within the past few years, and mostly the last four decades, has electricity grown from a seldom considered form of power to one of the most widely used. A new industry has grown up around it. New standards and new ways of doing things have developed in many lines of human activity. Since most of us have always had electricity to serve us, it is easy to take for granted the many things that it does. It is, therefore, very important that everyone be familiar, to a certain degree, with some of the important facts and concepts concerning the field of electricity.

Regardless of the manner in which one earns a living, he will have occasion to use electricity and electrical equipment. The interesting projects, experiments, studies and discussions of basic theoretical information that is presented in this unit will enable one to make use of electricity in the most satisfactory manner.

Scope:

a. 8th grade

b. 5 - 8 weeks (suggested)

Objectives

1. To develop in each pupil an understanding of the role of electricity in our daily lives.

2. To develop in each pupil an understanding of the basic electrical theories and operations.

3. To develop in each pupil an understanding of the various materials and products that are commonly used in electricity.

4. To develop in each pupil an understanding of electrical circuits and how they are connected and used.

5. To develop in each pupil a basic understanding of how we communicate by wire with electrical devices.

6. To develop in each pupil good work habits and safety procedures in the electrical area.

Objective: 1. To develop in each pupil an understanding of the role of electricity in our daily lives.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will gain an insight into the various methods of communication which we use today.	a. Read and do research assignments on the communications field as to its development or origin.
2. He will be introduced to the industries and companies which operate and use electrical communications systems and the methods and problems they encounter.	a. Take a field trip to local companies or observe films on these particular industries.
3. He will have a knowledge of some of the many jobs and opportunities to be found in the communications field.	a. Talk with men who are involved with these industries and write reports on their jobs and working conditions.

Objective: 2. To develop in each pupil an understanding of the basic electrical theories and operations.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know the early and present-day theories of electron flow.	a. Discuss the flow of electrons in various materials.
2. He will understand the principles of magnetism.	a. Conduct experiments with magnets to determine such things as polarity, lines of force and magnetic fields.
	b. Construct an electro-magnet.
	c. Magnetise a small tool.
3. He will know from what sources electricity is produced and how it is transmitted.	a. Construct a small cell using two unlike metals and an electrolyte.
4. He will be acquainted with and know how the basic electrical terms such as volt, ampere, ohm and watt are used.	a. Compare volt, ampere, ohm and watt by taking readings on a circuit.
	b. Read the watt-hour meter found at your home.

Objective: 3. To develop in each pupil an understanding of the various materials and products that are commonly used in electricity.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have an understanding of the various conducting and insulating materials.	a. Construct a chart showing different conductors and insulators. b. Test various materials to determine if they are insulators or conductors.
2. He will know what types of materials are most commonly used in the development of electrical devices.	a. Make an extension cord. b. Examine commercially produced products to determine the materials they are made of.
3. He will have an understanding of various kinds of wire and wire sizes.	a. Obtain samples of different wires and compare the current rating of each of them.
4. He will have an understanding of how simple communications devices operate.	a. Films on how the telegraph and telephone operate. b. Experiment with assembled communications components.

Objective: 4. To develop in each pupil an understanding of electrical circuits and how they are connected and used.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know the simple, series and parallel circuits; how they are wired, used and governed by certain laws.	a. Wire simple, series and parallel circuits.
2. He will understand Ohm's law and be able to use it.	a. Use Ohm's law to compute the electrical values found in different parts of a circuit.
3. He will know the different kinds of meters and how they are read and used.	a. Use meters to test various circuit problems.

Objective: 5. To develop in each pupil a basic understanding of how we communicate by wire with electrical devices.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know where and why we use the telephone, telegraph and tele-typewriter as forms of communication.	a. Conduct a research assignment to determine the uses of the various communication devices.
	b. Determine how many of these devices we come in contact with each day.
2. He will have a sound background on the operating principles of each of the wire communication devices.	a. Hook up and use telephones and telegraphs to determine how they operate.
3. He will construct representative articles which will enable him to gain valuable information on how these devices are built by industry.	a. Construct a simple telegraph with buzzers or lights.
	b. Construct a telephone from parts donated or purchased from local companies.

Objective: 6. To develop in each pupil good work habits and safety procedures in the electrical area.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will practice safety at all times when using tools and equipment.	a. Prepare safety bulletins and charts to illustrate points of safety in electricity.
2. He will know the importance of using the proper size wire and fusing devices.	a. Check homes for unsafe practices.
3. He will respect all forms of electricity as a potential danger if handled carelessly.	a. Observe films on safe electrical procedures.

Approach:

1. Conduct demonstrations showing the attraction-repulsion effect of magnets.
2. Construct a cell using a lemon and two unlike metals.
3. Wire 1½volt light bulbs in series and hook up to 120 volts.
4. Hook up a telegraph or a telephone and let students communicate with each other from different parts of the room.
5. Run a 100 watt light bulb wired to a watt-hour meter. Note the movement of the meter-continue to add bulbs and note the change in movement.
6. Cause a nichrome wire to glow red by passing electricity through it.

Activities:

1. Have pupils select and design a piece of communication equipment after discussing with them procedures which industry goes through and comparing them with those in the shop. Include limitations of the shop facilities, materials, pupil abilities, time, cost, learning experiences.
2. Have pupils develop drawings of the article selected.
3. Have pupils complete a materials list. Use procedures common to industry. Show materials catalogs and how suppliers list their products.
4. Develop with the pupils the principles of analyzing a sketch or drawing for details of construction and procedure. Stress logical sequence in construction activities.
5. Have pupils fabricate the article according to plan developed. Demonstrate the tool and machine processes involved, stress safety, principles involved, care for tools and machines and cooperation and regard for others.
6. Inspect and test article made, according to function, workmanship, marketability, and determine cost or probable selling price.
7. Optional - operate a mass production project and produce a piece of communication equipment.
8. Optional - study a primary industry that produces materials that are used in the manufacture of communication equipment.

Suggested Texts:

Arnold, Joseph P. and Schank, Kenneth L. Exploratory Electricity. Bloomington, Illinois: McKnight and McKnight Publishing Co., 1960.

Gerrish, Howard H. Electricity. Chicago: The Goodheart-Willcox Co., Inc., 1961.

Lush, Clifford K. and Engle, Glenn E. Industrial Arts Electricity, Peoria, Ill.: Chas. A. Bennett Co., Inc., 1959.

Resource Material:

Buban, Peter, and Schmitt, Marshall L. Understanding Electricity and Electronics. New York: McGraw-Hill Book Company, Inc., 1962.

Cornetet, Wendell H. Principles of Electricity. Bloomington, Ill.: McKnight and McKnight Publishing Company, 1952.

Dragoo, A.W., and Porter, G.B. General Shop Electricity. Bloomington, Ill.: McKnight and McKnight Publishing Company, 1952.

Jones, W.W. Fundamentals of Applied Electricity. Milwaukee: The Bruce Publishing Co., 1960.

Marcus, Abraham, Basic Electricity. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1958.

Steinberg, William B., and Ford, Walter B. Electricity and Electronics-Basic. Chicago: American Technical Society, 1957.

Suffern, Maurice Grayle, Basic Electrical and Electronics Principles. New York: McGraw-Hill Book Company, Inc., 1962.

Standard Industrial Classification Manual, Washington, D. C.: The Committee on Industrial Classification, Office of Statistical Standards, 1957.

Tools and Equipment:

Tools and equipment needed will be those found in a typical junior high school general shop. (See Appendix)

Materials and Supplies:

The following materials and supplies under most circumstances will be common in any shop but it is advisable to check each one in advance and procure any additional or special supplies as may be necessary to insure that there will be sufficient materials to carry on the program and to prevent time loss.

Wire (insulated, magnet, nichrome); Bells and buzzers; Sheet metal (brass, tin); Dry Cells; Solder (bar, rosin core); Electrical cord; Outlet plugs; Light bulbs; Tape (rubber, friction, electricians); Shellac; Screws; Nuts and Bolts; Wood (pine, hard wood); Insulated Staples; Surplus and out-dated equipment from local companies.

Lessons to be Taught:

This list of lessons was taken from the analysis of objectives.

Since the use of a variety of materials is encouraged but may not be practical in every instance, it would be more logical for manipulative lessons to be selected by the individual teacher to follow the general engineering and manufacture procedures used by industry to produce its products rather than by categories such as woodworking, metalworking, etc.

Lessons to be Taught: (continued)

Manipulative lessons then will fall into the following categories.

1. Engineering
    - Idea
    - Design
    - Sketching
    - Drawing
    - Materials list
    - Procedure of manufacture

2. Manufacture
    (concerned only with those tools needed in production of communication equipment. Listing of tools found in Appendix)

    a. Layout tools and procedures
    b. Cutting tools and procedures
    c. Forming and shaping tools and procedures.
    d. Holding tools and procedures
    e. Assembly tools and procedures
    f. Finishing tools and procedures
    g. Measuring and testing tools and procedures.

    Should include:
    (1) Recognize and select
    (2) Name correctly
    (3) Use properly and safely (To extent needed in manufacture of product)

Related Lessons:

This list of lessons was taken from the analysis of objectives and is in the nature of general statements of information to be taught rather than specific titles.

It should be noted that this list does not include films, discussions, and other teaching methods suggested to achieve the behavior changes.

1. Job opportunities available in the communication equipment field.
2. Transmission of electricity from generating plant to home.
3. Conductors and insulators.
4. Permanent and electromagnets.
5. Wire and wire sizes.
6. Voltages - sources and uses.
7. Electric current.
8. Resistance and its uses.
9. Series and parallel circuits.
10. Ohm's Law.
11. Operating principles of the telephone and telegraph.
12. Safety in handling electricity.

Teaching Aids or Devices: (Suggested Ideas)

Chalkboard

Charts (to be made by instructor)
  a. transmission of electricity from generator to home.
  b. diagram of a bell or buzzer.
  c. uses of electricity.

Prepared Sheets
  a. Uses of conductors and insulators.
  b. Ohm's Law
  c. Reading meters

Examples of conductors and insulators

Magnets and magnetic materials

Compass

Materials to make a coil

Wire gauge

Meters, dry cells, light bulbs, etc.

Evaluation Techniques:

Several methods of evaluating this unit are suggested below. To help the instructor make a complete evaluation it is suggested that all of these methods be utilized.

1. Unit evaluation - final examination.
2. Tests involving safety and operation of the machines.
3. Test on identification of tools.
4. Evaluation of the working drawing and plan of procedure.
5. Evaluation of the project (accuracy, design, etc.)
6. Evaluation of the individual (creativity, cooperation, interest, motivation, skills, individuality, etc.)

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavioral changes listed in the analysis of the objectives have been accomplished.

Manufacturing
Industries
Grade 9

82

Industrial Arts 83

Title of Unit: Manufacture of Workshop Tools and Equipment for the Home
(A study of a manufacturing industry)

Introduction:

This unit has been designed to introduce the pupil to the industrial world in which he lives. In order to better understand man's modern industry, we must first understand man himself. It is important to know how and why man was able to survive through the prehistoric age, the major reason being that man had a brain five times larger than the largest dinosaur. He also had the ability to stand and walk erect, thus freeing his hands to use a tool. It was tools, held in the hands for pounding, throwing, scraping, drilling, and cutting, that gave humans their superiority and began to multiply their strength.

In this unit, the pupil will gain an understanding of how man learned to use different materials. They will see more clearly how man improved and developed new tools. It was with these new and improved tools that man was able to build the great industrial nations of the world today.

The pupil will be introduced into the unit through the problem solving approach. He will gain a better understanding of the five basic types of tools: layout, cutting, leverage, striking, and special tools. He will have the opportunity to design and construct a tool or device that will be useful to him. Not only will the pupil have an understanding of the basic tools, but he will also have an understanding of how a tool company would set up and organize to produce the tool which he is making. This is important, as the pupil will some day play a part in his own industrial world.

As they become involved with the basic operations of the shop equipment, he will also become aware of tool care and shop safety.

Scope:

a. 9th grade

b. 8 - 9 weeks (suggested)

c. 200-275 minutes per week (min.)

Objectives

1. To develop in each pupil an understanding of and insight into the development and origin of the tool manufacturing industry.

2. To discover and develop in each pupil interests and talents of which he may not be aware.

3. To develop in each pupil problem-solving abilities related to the materials, processes, and products of the Workshop Tools and Equipment Industry.

4. To develop in each pupil a degree of skill in the safe use of tools and machines needed to produce a tool or piece of equipment for the Home Workshop.

Objective: 1. To develop in each pupil an understanding of and insight into the development and origin of the tool manufacturing industry.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know why man was able to gain his superiority over animals.	a. Discuss man's physical features. b. Make comparison to large dinosaurs.
2. He will know the different material stages man passed through in his development.	a. Discuss stone age. b. Discuss bronze age. c. Discuss inventions, such as the wheel and fire.
3. He will understand different methods of tool production used today.	a. Assign pupil reading assignment from text. b. Have pupil use different methods of tool production in the construction of his product. c. Have pupil make a bulletin board display showing different methods of tool production.

Objective: 2. To discover and develop in each pupil interests and talents of which he may not be aware.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize new areas with which he may not have been familiar.	a. Assign readings from text.
	b. Demonstrations in woodworking, foundry, and sheet metal.
	c. Have pupil construct a product in one area.
2. He will identify new types of material with which he may work.	a. Pupil sees fellow classmates using different materials.
	b. Assign readings from text.
3. He will develop ability to know and use a larger variety of tools.	a. Give pupil a guide sheet on tools.
	b. Demonstrations and lessons on tools and machine use.

Objective: 3. To develop in each pupil problem-solving abilities related to the materials, processes and products of the Workshop Tools and Equipment Industry.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will apply principles of design pertinent to products of these industries.	a. Discuss and show design principles applied in products of these industries--function, durability; material, color, etc.
2. He will follow a logical procedure in selecting a product.	a. Relate procedures used by industry in selecting product to manufacture to those in the industrial arts shop.
	b. Show pupil sources of ideas in catalogs, books, magazines. Use materials found in the home as well as in shop planning and research center.
	c. Have pupil visit gift shops, hardware and sporting goods stores, and others for ideas.
	d. Have pupil select a product (individual, group, or class) using procedures outlined.
3. He will make working sketches or drawings of selected workshop tool or equipment.	a. Show pupil sketches or drawings obtained from industry.
	b. Introduce pupil to basic sketching and drawing procedures.
	c. Have pupil sketch or draw article selected.
4. He will analyze drawings or sketches for materials needed.	a. Have pupil examine drawings for duplicate parts, sizes, fasteners, finishes, etc.
	b. Show method of recording materials on stock list.
	c. Show specimen stock lists used in industry.
	d. Discuss function of stock list.
	e. Have pupil complete a materials list.

Objective: 3. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
5. He will analyze drawings or sketches for procedures and/or construction details.	a. Have pupil complete a job or project plan for article selected. b. Discuss steps or procedures taken in fabrication of product and why each should follow a logical pattern. c. Show specimen article and have pupil analyze it for procedures and/or construction.
6. He will recognize and/or obtain materials selected.	a. Show and discuss characteristics of different materials. b. Have pupil examine storage racks and distinguish between materials. c. Show location of sources of materials in shop and in catalogs. d. Have pupil measure and cut out stock in rough. e. Have pupil check off stock list and label parts as they are obtained. Record sizes, if different.
7. He will inspect product and use suitable testing procedures.	a. Discuss need for inspection of industrial products, factors to be considered. b. Show different gauges and testing devices used in industry. c. Conduct durability tests on products of these industries. d. Use product made in shop and check parts with gauges or standards discussed.

Objective: 3. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
8. He will use labeling and/or instructional materials for identification and use of product.	a. Have pupil read and interpret labels on commercial products of the Workshop Tools and Equipment Industries.
	b. Discuss importance of reading labels and instructions or directions.
	c. Provide pupil opportunity to label his product and to prepare instructions or directions for care and use, if feasible.
9. He will use pricing techniques to determine sale value of product.	a. Analyze product completed in terms of material cost, time and labor, overhead and establish sale value. Relate procedures used by industry.
	b. Have pupil discuss market value of product and how industry tries to keep costs at a minimum.
	c. Compare prices of similar products to determine actual differences.
10. He will understand packaging and distribution procedures.	a. Demonstrate need for correct packaging of product for distribution.
	b. Display typical packaging materials used by industry.
	c. Assign committee to investigate postal regulations and procedures on packaging.
	d. Discuss procedures used to get product to distribution terminals or centers.

Objective: 4. To develop in each pupil a degree of skill in the safe use of tools and machines needed to produce a tool or piece of **equipment** for the Home Workshop.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use layout, cutting, forming, shaping, holding, assembly, and finishing tools and procedures.	a. Lessons over those layout, cutting, forming, shaping, holding, assembly and finishing tools needed for the construction of the tools or piece of equipment. b. Have pupil locate and name the layout, cutting, forming, shaping, holding, assembly and finishing tools he will use.
2. He will report damaged tools or equipment to instructor.	a. Discuss reasons of tool breakage. b. If possible, have student make needed repair.
3. He will become familiar with the location of tools and return them to their proper places.	a. The pupil will participate in a personnel organization. b. Discuss color coding of tool panels.
4. He will select and use machines and procedures.	a. Lessons over machines needed in the construction of a tool or piece of equipment. b. Have pupil demonstrate safe operation of machines he will use.
5. He will gain knowledge of the safety factors peculiar to each individual piece of equipment in the laboratory.	a. Prepare safety signs and displays for bulletin board. b. Arrange for safety engineer in personnel plan.
6. He will become more aware of the safety programs carried on in all industrial plants today.	a. Have tests over safety standards in the shop. b. Have pupil take permit slips to parents for signatures.
7. He will participate actively in the safety program of the school industrial arts laboratory.	a. Have pupil work with instructor to organize safety program.

Approach:

1. A talk by the instructor in which he discusses man's development and the importance of tools.

2. A display of tools or tool charts showing the development of tools and man.

3. A talk by a man in the profession telling of the opportunities in the field.

4. Motion pictures or slides pertinent to the subject matter.

5. A field trip.

Activities:

1. Have pupils select and design a workshop tool or piece of equipment after discussing with them procedures which industry goes through and comparing them with those in the shop. Include limitations of the shop facilities, materials, pupil abilities, time, cost, learning experiences.

2. Have pupils develop drawings of the article selected.

3. Have pupils complete a materials list. Use procedures common to industry. Show materials catalogs and how suppliers list their products.

4. Develop with the pupils the principles of analyzing a sketch or drawing for details of construction and procedure. Stress logical sequence in construction activities.

5. Have pupil fabricate the article according to plan developed. Demonstrate the tool and machine processes involved, stress safety, principles involved, care for tools and machines and cooperation and regard for others.

6. Inspect and test article made, according to function, workmanship, marketability, and determine cost or probable selling price.

7. Optional - operate a mass production project and produce a workshop tool or a piece of equipment.

8. Optional - study a primary industry that produces materials that are used in the manufacture of workshop tools and equipment.

Suggested Texts:

Groneman, Chris H. and Feirer, John L. General Shop. New York: McGraw-Hill Book Company, Inc., 1963.

Ludwig, Oswald A. Metalwork Technology and Practice. Bloomington, Illinois: McKnight and McKnight Publishing Co., 1962.

Olson, Delmar W. Industrial Arts for the General Shop. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1961.

Resource Material:

Feirer, John L. Drawing and Planning for Industrial Arts. Peoria, Ill.: Chas. A. Bennett Co., Inc., 1963.

Feirer, John L. Industrial Arts Woodworking. Peoria, Ill.: Chas. A. Bennett Co., Inc., 1959.

Feirer, John L. Advanced Woodwork and Furniture Making. Peoria, Ill.: Chas. A. Bennett Co., Inc., 1963.

Gerbracht, Carl, Robinson, Frank E., Hanks, William S., Understanding America's Industries. Bloomington, Illinois: McKnight and McKnight Publishing Co., 1962.

Smith, Robert E. Forging and Welding. Bloomington, Ill.: McKnight and McKnight Publishing Co., 1958.

Smith, Robert E. Bench Metal Work. Bloomington, Ill.: McKnight and McKnight Publishing Co., 1958.

Tools and Equipment:

Tools and equipment needed will be those found in a typical high school general shop. (See Appendix)

Materials and Supplies:

Pine stock; Galvanized sheet metal; Dowels; 5/8" band iron; Zamak; 1/4" tool steel rod; screws, rivets, glue, etc.; Roll pins; Plastic dip (finish); Various types of finish (spray & brush).

Lessons to be Taught:

This list of lessons was taken from the analysis of objectives.

Since the use of a variety of materials is encouraged but may not be practical in every instance, it would be more logical for manipulative lessons to be selected by the individual teacher to follow the general engineering and manufacturing procedures used by industry to produce its products rather than by categories such as woodworking, metalworking, etc.

Manipulative lessons then will fall into the following categories.

1. Engineering
    - Idea
    - Design
    - Sketching
    - Drawing
    - Materials list
    - Procedures of manufacture

2. Manufacture
    (Concerned only with those tools needed in production of Workshop Tools and Equipment for the Home. Listing of tools found in the Appendix)

Lessons to be Taught:
Manipulative Lessons: (Continued)

a. Layout, cutting, forming, shaping, holding, assembly, and finishing tools and procedures should include
    (1) Recognize and select
    (2) Name correctly
    (3) Use properly and safely (To extent needed in manufacturing of product)

b. Machines and procedures should include
    (1) Name correctly
    (2) Use properly and safely (To extent needed in manufacture of product)

Related Lessons

This list of lessons was taken from the analysis of objectives and is in the nature of general statements of information needed to be taught rather than specific titles.

It should be noted that this list does not include films, discussions and other teaching methods suggested to achieve the behavior changes.

1. Various occupations found in the Home Workshop Tool and Equipment Industry.
2. Principles of design (review).
3. Sketching and drawing a tool or a piece of equipment for the home workshop.
4. Characteristics of the various materials used in the manufacture of a tool or a piece of equipment.
5. Inspecting and evaluating a finished product.
6. Labeling procedures used by industry.
7. Packaging procedures used by industry.
8. Pricing and distributing a finished product.
9. Quality of workmanship and standards in manufactured products.

Teaching Aids or Devices: (Suggested Ideas)

Films:

The A. B. C. of Hand Tools
Story of Prehistoric Man, University of Maine, BW, 11 min. (2.25)
Simple Machines, University of Maine, BW, 11 min. (2.25)
Scientific Method, University of Maine, BW, 12 min. (2.25)
Safe Use of Tools, University of Maine, BW, 6 min. (2.25)
Machine Maker, (2nd Ed.), University of Maine, BW, 11 min. (2.25)
Let's Measure; Inches, Feet, and Yards, University of Maine, BW, 11 min. (2.25)
How Machines and Tools Help Us, University of Maine, BW, 11 min. (2.25)
From Trees to Lumber, University of Maine, BW, 11 min. (2.25)
Drawing in the Shop, University of Maine, BW, 11 min. (2.25)

Teaching Aids or Devices: (continued)

Flannel Board:

Used in a lesson on installing wood screws.

Electric Board:

Used to illustrate - 1. The types of lines used in drawing.
2. The different materials used in the lab.

Magnetic Chart:

Used in a lesson dealing with the three view drawing.

Chart: Civilization Through Tools

Used in the introduction of this unit.

Information Sheets and Instruction Sheets:

1. Things to Know About the Foundry.
2. Types of Lines.
3. Five Classifications of Tools.
4. Steps of Problem Solving.
5. How to Forge Tool Steel.

Evaluation Techniques:

During the period of time which this unit will encompass, occasional tests and quizzes will be given. They will include the various techniques and methods listed below. There will be a major test at the end of the first six weeks, and a final exam at the end of the unit.

Techniques:

1. Performance tests.
2. Completion questions.
3. Multiple choice questions.
4. Recall items.
5. Tool identification tests.
6. Self-evaluation sheets.
7. Teacher observation.

Note: Examples of tests, quizzes and other material of this nature can be found in (Industrial Arts Notebook), which follows this unit.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavior changes listed in the analysis of the objectives have been accomplished.

Title of Unit: Manufacture of Small Furniture for the Home (A study of a manufacturing industry)

Introduction:

Industry is the backbone of our economic society; it is the process through which we are able to grow and expand. Everything we have before us, other than natural resources, has been manufactured in an industrial plant. Industry cannot be valued in terms of dollars and cents, for the growth of our country depends on it. Therefore, it is important that our youth be familiar with manufacturing procedures. By utilizing the unit, "Small Furniture for the Home", we can correlate the industrial arts program with our American Industries.

The pupil will experience the planning and constructing of a piece of furniture and this should result in a greater understanding of the functions of industry.

Scope:

a. 9th grade

b. 9 - 10 weeks (suggested)

c. 200 - 275 minutes per week (min.)

Objectives

1. To develop in each pupil an insight into and understanding of the small furniture industry and its place in our society.
2. To discover and develop pupil interests and talents in the small furniture industry.
3. To develop in each pupil problem-solving abilities related to the materials, processes and products of furniture making.
4. To develop in each pupil a degree of skill in the safe use of tools and machines.

Objective: 1. To develop in each pupil an insight into and understanding of the small furniture industry and its place in our society.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know the variety and sizes of various furniture industries.	a. Discuss the various types of furniture industries. b. Show an exhibit of some small furniture produced commercially. c. Invite guest speakers to present materials on furniture production.
2. He will be aware of the important role that the manufacturing of small furniture plays in our present society.	a. Discuss the part these industries play in people's lives in terms of job opportunities, need for these articles, and development of hobby interests. b. Discuss working conditions, salaries and job requirements.
3. He will know the need of having a small furniture industry in a community.	a. Have pupil list various small furniture produced for the home. b. Discuss marketing, consuming, supply and demand. c. Explain and discuss the formation of a company and its association with industrial arts. d. Have pupil discuss various job opportunities that are available in a small furniture industry.
4. He will recognize the place of research and development in the furniture industry.	a. Compare articles of different years and the effects of research. b. Display charts showing new developments in industry. c. Encourage pupil to read "Popular Science" or similar magazines to learn of research and inventions.

Objective: 2. To discover and develop pupil interests and talents in the small furniture manufacturing industries.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know that salesmen sell the product that is produced by the small furniture manufacturing industries.	a. Discuss with the class the requirements for entering the sales field. b. Bulletin board - "The organization chart of a typical sales division of a manufacturing concern."
2. He will know that the design engineers create the style and physical structure of the product in the form of blueprints or specifications.	a. Have pupil prepare a guidance folder covering the design engineering field in a manufacturing industry. b. Lesson on establishing the standards to which the product shall be made. c. Have pupil conduct tests on various purchased products.
3. He will know that the industrial engineers make the materials list and plan the procedures on how the product will be manufactured.	a. Show materials list and operation and route sheets used by industry. b. Bulletin board - "The organization of a typical methods engineering department".
4. He will know the accounting department pays bills for all company costs.	a. Have speaker from accounting department of a local manufacturing concern. b. Lesson on cost accounting system used by a small manufacturing industry.
5. He will know that parts control stores the manufacturing parts and purchases materials.	a. Lesson on how parts and materials are transported to, within and from the manufacturing plant. b. Discuss with pupil "lot buying".
6. He will know that the industrial relations hires, trains, and places personnel in a manufacturing industry.	a. Have pupil make out an application for employment. b. Have pupil prepare a guidance folder covering the industrial relations department of a manufacturing concern.

Objective: 2. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
7. He will know that the production planning department determines the means by which the product and its components shall be made.	a. Lesson on "Tooling up". b. Discussion on routing of parts and plant layout. c. Lesson on how tools, jigs and fixtures are designed for the making of different products. d. Lesson on how tools are controlled and dispensed during the manufacturing of the product.
8. He will know that the production line produces and assembles the parts.	a. Discussion of the various occupations found in the production line of a manufacturing concern.
9. He will know that the maintenance department services present machines, installs new machines and aids in rearranging production facilities.	a. Discussion of the various occupations found in a Plant Maintenance Department.
10. He will know that the quality control department inspects parts and the finished products.	a. Discussion on how this department controls salvage. b. Discussion on the importance of inspector in a continuous manufacturing concern.
11. He will use his time effectively.	a. Have pupil determine his own efficiency by comparing estimated time with actual time in completing a product.
12. He will work cooperatively with members of his class.	a. Provide opportunity for group or class projects. b. Establish policies with pupil in relation to use of tools, equipment and other shop facilities.

Objective: 2. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
13. He will observe safety standards, posters, signs and regulations.	a. Give pupil opportunity to prepare a safety bulletin board. b. Check out pupil on hazardous operations. c. Provide for periodic safety checks. d. Provide for a safety engineer in personnel organization to check pupil's use of goggles, gloves, guards and other safety devices. He may also report dangerous conditions of tools or equipment and/or assume initiative in correcting them. e. Discuss the importance industry places upon safety.
14. He will recognize the difference between workers as to pay, training, responsibilities.	a. Compare requirements of workers for different jobs within an industry. b. Show trends and needs for adequate education in most industrial fields. c. Show industrial film and point out need for different types of work.

Objective: 3. To develop in each pupil problem-solving abilities related to the materials, processes and products of furniture making.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will apply principles of design pertinent to products of this industry.	a. Discuss and show design principles applied in products of this industry – function, durability, material, color, etc.
	b. Have pupil examine and evaluate design principles used in products of this industry.
2. He will follow logical procedure in selecting product.	a. Relate procedures used by industry in selecting product to manufacture to those in the industrial arts shop.
	b. Show pupil sources of ideas in catalogs, books and magazines. Use materials found in the home as well as in shop planning and research center.
	c. Have pupil visit gift shops, hardware and other stores for ideas.
	d. Have pupil select a product (individual, group or class) using procedures outlined.
3. He will make working sketches or drawings of selected product.	a. Show pupil sketches or drawings obtained from industry.
	b. Have pupil sketch or draw a piece of small furniture.
4. He will analyze drawings or sketches for materials needed.	a. Have pupil examine drawings for duplicate parts, sizes, fasteners, finishes, etc.
	b. Show method of recording materials on stock list.
	c. Have pupil make materials list of items needed for piece of small furniture selected.

Objective: 3. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
5. He will analyze drawings or sketches for procedure and/or construction details.	a. Have pupil complete a job or project plan for small piece of furniture. b. Discuss steps or procedures taken in fabrication of product and why each should follow a logical pattern. c. Show specimen article and have pupil analyze it for procedures and/or construction.
6. He will recognize and/or obtain materials selected.	a. Show and discuss characteristics of different materials. b. Have pupil examine storage racks and distinguish between materials. c. Show location of sources of materials in shop and in catalogs.
7. He will inspect product and use suitable testing procedures.	a. Conduct durability tests on products of the small furniture industry. b. Use products made in shop and check parts with gauges or standards. c. Have pupil use a product evaluation form to inspect or evaluate his work.
8. He will use labeling and/or instructional materials for identification and use of product.	a.. Provide pupil opportunity to label his product and to prepare instructions or directions for care and use, if feasible.
9. He will use pricing techniques to determine sale value of product.	a. Analyze product completed in terms of material cost, time and labor, overhead. Establish sale value. Relate procedures used by industry.

Objective: 3. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
10. He will understand packaging and distribution procedures.	a. Assign committee to investigate postal regulations and procedures on packaging. b. Discuss procedures used to get product to distribution terminals or centers.
11. He will recognize quality workmanship and standards in the products of these industries.	a. Have pupil write a comparison report on two "brand name" products of these industries. b. Assign reading in Consumer Report or other reliable consumer magazine.

Objective: 4. To develop in each pupil a degree of skill in the safe use of tools and machines.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use layout tools and procedures.	a. Lessons over layout tools needed in the construction of the product. b. Have pupil locate and name the layout tools he will use.
2. He will recognize and use cutting tools and procedures.	a. Lessons over cutting tools needed in the construction of the product. b. Have pupil locate and name the cutting tools he will use.
3. He will recognize and use forming and shaping tools and procedures.	a. Lessons over forming and shaping tools needed in the construction of the product. b. Have pupil locate and name the forming and shaping tools he will use.
4. He will recognize and use holding tools and procedures.	a. Lessons over holding tools needed in the construction of the product. b. Have pupil locate and name the holding tools he will use.
5. He will recognize and use assembly tools and procedures.	a. Lessons over assembly tools needed in the construction of the product. b. Have pupil locate and name the assembly tools he will use.
6. He will recognize and use finishing tools and procedures.	a. Lessons over finishing tools needed in the construction of the product. b. Have pupil locate and name the finishing tools he will use.

Objective: 4. (continued)

Expected pupil behavioral change	Suggested activities to implement the change
7. He will select and use machines and procedures.	a. Lessons over machines needed in the construction of the product. b. Have pupil demonstrate safe operation of machines he will use.
8. He will care for tools, equipment and facilities.	a. Have pupil return tools to proper panels as soon as he finishes using them. b. Show pupil simple maintenance procedures on tools and equipment used.

Approach:

1. Set up bulletin board displays showing small pieces of furniture to stimulate interest and motivate constructive thinking.

2. Provide display of small pieces of furniture similar to what may be constructed in the shop.

3. List various catalogs, magazines and publications on chalkboard for reference ideas.

4. Discuss with pupils possible articles of small furniture which may be produced.

5. Tour the shop and show the tools and equipment available and pertinent to the unit.

Activities:

1. Have pupils select and design a small piece of furniture after discussing with them procedures which industry goes through and comparing them with those in the shop. Include limitations of the shop facilities, materials, pupil abilities, time, cost, learning experiences.

2. Have pupils develop drawings of the article selected.

3. Have pupils complete a materials list. Use procedures common to industry. Show materials catalogs and how suppliers list their products.

4. Develop with the pupils the principles of analyzing a sketch or drawing for details of construction and procedure. Stress logical sequence in construction activities.

5. Have pupils fabricate the article according to plan developed. Demonstrate the tool and machine processes involved, stress safety, principles involved, care for tools and machines and cooperation and regard for others.

6. Inspect and test article made, according to function, workmanship, marketability, and determine the cost or probable selling price.

7. Optional - operate a mass production project and produce a small piece of furniture.

8. Optional - study a primary industry that produces materials that are used in the manufacture of small furniture.

Suggested Texts:

Boyd, T. Gardner. Metalworking. Chicago: The Goodheart-Wilcox Co., Inc., 1961.

Groneman, Chris H. Exploring the Industries. Austin, Texas: The Steck Co., 1953.

Groneman, Chris H. and Feirer, John L. General Shop. New York: McGraw Hill-Book Company, Inc., 1963.

Olson, Delmar W. Woods and Woodworking for Industrial Arts. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1958.

Suggested Texts: (contimued)

Wagner, Willis H. *Woodworking*. Chicago: The Goodheart-Wilcox Co., Inc., 196[illegible].

Resource Material:

Bradley, Charles B. *Design in the Industrial Arts*, Peoria, Illinois: Chas. A. Bennett Co., Inc., 1952.

Coover, Shriver L. *Drawing, Sketching and Blueprint Reading*. New York, New York: McGraw-Hill Book Co., 1954.

Cunningham, Beryl M. and Holtrop, William F. *Woodshop Tool Maintenance*, Peoria, Illinois: Chas. A. Bennett Co., Inc., 1956.

Feirer, John L. *Industrial Arts Woodworking*. Peoria, Illinois: Chas A. Bennett Co., Inc., 1960.

Fryklund, Verne C. and LaBerge, Armand J. *General Shop Bench Woodworking*. Bloomington, Illinois: McKnight and McKnight Publishing Company, 1955.

Hammond, James J., Donnelly, Edward T., Harrod, Walter F., and Rayner, Norman A. *Woodworking Technology*. Bloomington, Illinois: McKnight and McKnight Publishing Co., 1961.

Ishimoto, Tatsuo. *The Art of Driftwood and Dried Arrangements*. New York, New York: Crown Publishers, Inc., 1960.

Ludwig, Oswald A. *Metalwork Technology and Practice*. Bloomington, Illinois: McKnight and McKnight Publishing Company, 1962.

Lux, Donald G. and Towers, Edward R. *Contemporary Metal Home Furnishings*. Bloomington, Illinois: McKnight and McKnight Publishing Company, 1957.

Osburn, Burl N. *Constructive Design*. Milwaukee, Wisconsin: Bruce Publishing Company, 1948.

Sekely, Dezso, *Contemporary Industrial Arts Projects*. Bloomington, Illinois: McKnight and McKnight Publishing Company, 1956.

Smith, Robert E. *Etching, Spinning, Raising and Tooling Metal*. Bloomington, Illinois: McKnight and McKnight Publishing Company, 1951.

Smith, Robert E. *Machine Woodworking*. Bloomington, Illinois: McKnight and McKnight Publishing Co., 1958.

Sorderberg, George A. *Finish Materials and Methods*. Bloomington, Illinois: McKnight and McKnight Publishing Company, 1959.

Tilton, George. *Home Workshop Projects*. New York, New York: Arco Publishing Company, Inc., 1952.

Tools and Equipment:

Tools and equipment needed will be those found in a typical high school general shop (See Appendix).

Materials and Supplies:

Pine; Cedar; Cherry; Mahogany; Galvanized sheet metal; Various sizes of band iron; Various sizes of cold roll steel; Various sizes of plastics; Various types of fastening devices; Various types of finishing materials.

Lessons to be Taught:

This list of lessons was taken from the analysis of objectives.

Since the use of a variety of materials is encouraged but may not be practical in every instance, it would be more logical for manipulative lessons to be selected by the individual teacher to follow the general engineering and manufacture procedures used by industry to produce its products rather than by categories such as wood working, metalworking, etc.

Manipulative lessons then will fall into the following categories.

1. Engineering
   - Idea
   - Design
   - Sketching
   - Drawing
   - Materials list
   - Procedures of manufacture

2. Manufacture
   (Concerned only with those tools needed in production of small furniture for the home. Listing of tools found in the Appendix).

   a. Layout tools and procedures should include
      (1) Recognize and select
      (2) Name correctly
      (3) Use properly and safely (To extent needed in manufacture of product)

   b. Cutting tools and procedure should include
      (1) Recognize and select
      (2) Name correctly
      (3) Use properly and safely (To extent needed in manufacture of product)

   c. Forming and shaping tools and procedures should include
      (1) Recognize and select
      (2) Name correctly
      (3) Use properly and safely (To extent needed in manufacture of product)

Lessons to be Taught:

Manipulative Lessons: (Continued)

d. Holding tools and procedures should include
   (1) Recognize and select
   (2) Name correctly
   (3) Use properly and safely (To extent needed in manufacture of product)

e. Assembly tools and procedures should include
   (1) Recognize and select
   (2) Name correctly
   (3) Use properly and safely (To extent needed in manufacture of product)

f. Finishing tools and procedures should include
   (1) Recognize and select
   (2) Name correctly
   (3) Use properly and safely (To extent needed in manufacture of product)

g. Machines and procedure should include
   (1) Name correctly
   (2) Use properly and safely (To extent needed in manufacture of product)

Related Lessons

This list of lessons was taken from the analysis of objectives and is in the nature of general statements of information needed to be taught rather than specific titles.

It should be noted that this list does not include films, discussions, and other teaching methods suggested to achieve the behavior changes.

1. Establishing the standards to which the product shall be made.
2. Cost accounting system of a manufacturing concern.
3. Transportation of parts and materials used in manufacturing.
4. Meaning of tooling up.
5. Designing of tools, jigs and fixtures.
6. Controlling and dispensing tools during the manufacture of the product.
7. Principles of design (review).
8. Sketching and drawing a small piece of furniture for the home.
9. Characteristics of the various materials used in the manufacture of a small piece of furniture for the home.
10. Inspecting and evaluating a finished product.
11. Labeling products.
12. Packaging procedures used by industry.
13. Pricing and distributing a finished product.
14. Quality of workmanship and standards in manufactured products.

Teaching Aids or Devices: (Suggested Ideas)

1. Chalkboard and chalk
2. Demonstration bench
3. Flannel board
4. Sample furniture
5. Pieces of wood showing kinds
6. Pieces of sheet metals showing kinds
7. Pieces of wood showing finishes
8. Flip cards - Tool identification
9. Flow charts
    a. Organization of an industry.
    b. Products of wood industry.
    c. Products of metal industry.
    d. Product - from raw material to finished article.
10. Safety charts

Evaluation Techniques:

There are several techniques which may be used to evaluate this unit. The following are suggestions to help realize this evaluation.

1. Observation of the pupils at work.
2. Attitudes and cooperation while in the shop.
3. Safety tests.
4. Periodic quizzes and exams.
5. Tool identification tests.
6. Evaluation of skills, both manipulative and related.
7. Project evaluation.
8. Final examination.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavior changes listed in the analysis of the objectives have been accomplished.

Title of Unit: Production Industries (A study of mass production)

Introduction:

The standard of living to which we are accustomed, and take for granted, is indeed the envy of all nations. Our luxurious homes, modern transportation systems, large shopping centers, and numerous other "American ways of living" make ours a nation of which we may be proud.

All of this has happened in a relatively short period of time, as our nation is still comparatively young. Since we are a new nation we have had at our disposal a vast supply of natural resources.

By coupling these natural resources with ingenuity and inventiveness, we have produced a system of production and manufacturing which is the key to our way of life. This key is the manufacturing technique referred to as mass production.

Through means of this unit concerned with mass production manufacturing concepts each pupil will have been exposed to the basic elements which make our nation the technological giant it is today.

Scope:

a. 9th grade

b. 9 weeks suggested

c. 200 to 275 minutes per week (min.)

Objectives

1. To develop in each pupil an insight and understanding of manufacturing industries utilizing mass production techniques and their resultant effect on our way of life.
2. To develop in each pupil desirable interests, attitudes and appreciations relative to the work, its organization, and the worker in the industries utilizing mass production techniques.
3. To develop in each pupil through problem-solving situations an understanding of the processes, materials and products characteristic of production manufacturing.
4. To develop in each pupil a degree of skill in the safe use of tools and machines related to or used in conjunction with the study of the mass production manufacturing industry.

Objective: 1. To develop in each pupil an insight and understanding of manufacturing industries utilizing mass production techniques and their resultant effect on our way of life.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will be aware of the major classifications of manufacturing industries.	a. List and classify manufactured products with which pupil is familiar.
	b. List and classify local industries.
2. He will be aware of the interdependence of producers of raw materials, tools and machines, and the manufacturing industries.	a. Select a common manufactured product and analyze to show how many industries are involved.
	b. Have pupil select an article at home and indicate the name and number of industries involved in its manufacture.
3. He will be aware of major manufacturing industries on the national, state and local levels.	a. Refer to "Census of Manufacture" and indicate which local or state industries are of national importance.
	b. Refer to "Census of Manufacture" and note what industries are classified as major.
	c. Prepare a chart showing numbers employed in each of the major industries at the state and/or local levels.
4. He will have a knowledge and understanding of the history of manufacturing and its importance to man.	a. Bulletin board display.
5. He will have an understanding of the importance of mass production and industry and its place in industrial arts.	a. Discussion - mass producing a project in I. A. through line production.

Objective: 1. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. He will read intelligently concerning industry and industrial products.	a. Assign readings concerning selected manufacturing industries and industrial products. b. Have pupil make short written reports concerning assigned readings. c. Discuss reports to bring out important points. d. Stress the importance of industry and our way of life. e. Havė pupil clip and bring to class newspaper or magazine articles dealing with industrial topics. f. Pupil could maintain a section in his notebook devoted to material gathered in fulfilling required assignments.
7. He will realize that industry performs three basic functions (1) Finance (2) Produce, assemble, acquire, goods or services (3) Distribute to consumer	a. Notesheet. b. Discussion - lesson.
8. He will realize the basic purpose of most industrial enterprises, - to make a profit by supplying a product or service at a time, place, and price to induce a consumer to buy.	a. Introductory lesson..
9. He will have a basic understanding of automation and how it differs from machine mechanization.	a. Study sheet. b. Lesson.

Objective: 1. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
10. He will have acquired a mastery of terms associated with the study of manufacturing.	a. Study sheet.
11. He will be aware of the effect of mass production on servicing.	a. Discussion.
12. He will have an understanding of primary industry and the role it plays in mass production manufacturing.	a. Assignment.
13. He will understand vertical and horizontal integration.	a. Assignment.
14. He will be able to distinguish between custom and mass production.	a. Discussion.
15. He will have a basic philosophy of conservation and will realize its importance to industry.	a. Lesson - Discussion. b. Assignment.

Objective: 2. To develop in each pupil desirable interests, attitudes and appreciations relative to the work, its organization, and the worker in the industries utilizing mass production techniques.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will understand the organization of a manufacturing industry and be able to organize the class. (Line organization and Line & Staff organization). a. Management function and basic responsibilities. b. Through basic principles that are fundamental to any organization.	a. Study sheets. b. Discussion - Lesson. c. Assignment. Work out organization for Ind. Arts company.
2. He will be able to intelligently plan a workable organization for a company.	a. Plan company organization.
3. He will be aware of the types of ownership - proprietorship, partnership, corporation.	a. Information sheet.
4. He will be aware of basic or typical occupations.	a. Assignment sheets. b. Prepare a chart or graph showing numbers employed in each of the major industries at state and local levels.
5. He will have an understanding of factors to consider when selecting a job.	a. Lesson - Occupational choice factors.
6. He will have an understanding of personnel management.	a. Lesson. b. Advertise on bulletin board for workers to perform certain tasks--interview and assign.
7. He will have a basic understanding of the relationship between wages and prices and supply and demand and prices.	a. Lesson - Wages and prices, and supply and demand.
8. He will have a knowledge of how wages are determined and payment plans. Workmen's Compensation Social Security	a. Lesson - Wages and Reasons for differences. b. Information sheet.

Objective: 2. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
. He will realize the importance of employee relations.	a. Lesson.
10. He will have an understanding of the role of organized labor.	a. Lesson.
	b. Discussion.
11. He will realize the importance of lighting, noise, and plant climate.	a. Study sheet.
	b. Discussion.
12. He will appreciate the importance of safety and health programs in industry.	a. Lesson
	b. Discussion.
	c. Prepare safety signs and bulletin board display.
	d. Periodic safety tests.
	e. Shop safety inspection.
13. He will know what is meant by business statesmanship.	a. Discussion.
14. He will work cooperatively in group activities.	a. Have pupil participate in a mass production activity.
	b. Discuss the need for cooperation in order to promote group progress.
	c. Be on the alert for cases of noncooperation and discuss the problem personally with those concerned.
15. He will be aware of and observe safety standards, posters, signs and regulations.	a. Prepare safety signs and bulletin board displays.
	b. Arrange for safety engineer for shop and for mass production activity.
	c. Provide for periodic testing concerning safety standards in the laboratory.

3

Objective: 3. To develop in each pupil through problem-solving situations an understanding of the processes, materials and products characteristic of production manufacturing.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a good understanding of the overall function and operations, etc. of a mass producing manufacturing industry.	a. Participate in the forming of a company and the mass producing of a product through the line production technique and other activities that simulate actual industrial operations.
2. He will have an awareness as to the extent of mass produced articles on the market today.	a. Discussion - variety of mass produced articles.
3. He will have a better understanding of the difference between custom and mass produced articles and the effects of mass production and automation on quality and price.	a. Lesson - Custom vs Mass Production.
4. He will realize the factors or consideration in plant location.	a. Study sheet. b. Discussion.
5. He will be aware of basic principles in building planning.	a. Study sheet. b. Discussion.
6. He will have a thorough understanding and appreciation of research and development and its role in industry. Reasons for: types; dept. functions; market and motivation research; planning a new product.	a. Study sheet. b. Lesson - discussion. c. Assignment. Project ideas. d. Design lesson. e. Lesson - Types of Pictorial drawing. f. Lesson - Sketching techniques.
7. He will understand the meaning and significance of standardization, simplification, and specialization in industry.	a. Study sheet. b. Discussion.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
8. He will be able to apply principles of design in designing a product to be produced.	a. Discuss design principles as they pertain to manufactured products-aesthetics, function, material and production method. b. Have pupil design articles and prepare a sketch. c. Have pupil select best drawing.
9. He will be able to make an accurate set of plans of the product to be produced.	a. Drawing review course 1. Working drawing. 2. Pictorial drawing. 3. Exploded view assembly drawings. b. Make a set of plans of the product. c. Show industrial drawings and discuss. Distinguish between white prints, blue prints, xerography, thermography.
10. He will be able to prepare materials specifications for article.	a. Use manufacturer's and supplier's catalogs for listing materials to be used. b. Estimate the cost of materials used in the article. c. Check availability of material in the shop or from local suppliers.
11. He will be able to identify materials in the shop and also know what new materials are available.	a. Demonstration - lesson. b. Reports on new materials used in manufacture. c. Prepare and distribute information concerning common fastening devices. d. Prepare and distribute information concerning common finishing materials.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
12. He will know how materials are procured.	a. Encourage and insist on correct layout and getting out stock. Utilize scrap materials first. b. Have each pupil responsible for maintaining a daily work report. Include activity and time spent. c. Discussion. d. Investigate materials available and evaluate and select best ones. e. Compare materials orders. f. Prepare material order and estimate cost.
13. He will understand the importance of materials handling and be able to set up the handling of materials for the product being produced.	a. Prepare plan for handling materials in production of product.
14. He will know what is meant by inventory control.	a. Lesson.
15. He will understand what is meant by budget control.	a. Discussion.
16. He will have an understanding of the business end of a manufacturing industry.	a. Reading assignment.
17. He will be able to analyze a product for production planning. a. Job breakdown b. Operations breakdown	a. Reading assignment. b. Analyze a product for production.
18. He will be able to determine procedures by which the article and its components may be produced.	a. Have pupil study drawing prepared and note parts, materials, shapes, and sizes. b. Have pupil analyze facilities, time, cost, and other factors considered in fabricating the article.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
18. (continued)	c. Discuss the concept of mass production and the techniques involved. d. Have pupil list steps to be followed in producing the article with special emphasis on its components. e. Check procedures for accuracy and efficiency.
19. He will understand what is meant by - "we never find the best way".	a. Discussion.
20. He will understand the objectives, types, and considerations of plant layout.	a. Reading assignment.
21. He will be able to layout a plant for production of the product.	a. Layout the shop for production on paper. b. Construct a flow chart (schematic) of the product.
22. He willrealize and understand the importance of work study and measurement.	a. Lesson - Discussion.
23. He will understand the meaning and importance of production control and prepare plan for product.	a. Production control planning.
24. He will understand how industry would produce the product.	a. Explain production processes. b. Field trip.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
25. He will be able to select and apply finish for product.	a. Lesson - finishes & then application
	b. Discussion - newer finishing methods in use today.
26. He will be able to recognize quality workmanship and standards in manufactured products.	a. Display products which exemplify different workmanship standards. Point out quality factors.
27. He will realize the importance and meaning of inspection and quality control.	a. Study sheet.
	b. Lesson.
	c. Design, make & use a gauge.
	d. Participate in inspection of product.
	e. Assign report of instruments used in manufactures for testing.
	f. Explain inspection tags; use and function.
28. He will be able to establish cost of finished product.	a. Study material cost, time requirement, special processes, and labor costs to determine value of article made.
	b. Discuss effects of mass production of quality and price of products so made.
	c. Discuss effects of supply and demand on cost of consumer goods.
29. He will have an understanding of sales techniques used today - advertising, etc.	a. Prepare ad for product.
	b. Discussion.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
30. He will be aware of how articles are prepared for delivery.	a. Use screen or other printing process for labeling product and preparing direction for use or care.
	b. Discuss proper packaging and labeling techniques for different products as glass, ceramics, textile, etc.
	c. Compare shipping cost using different methods, parcel post, railway, express, air freight. Zoning and rate schedules..
	d. Film "Paperboard Packing" Association Film, Inc., 35 West 45th Street, N. Y.
31. He will understand how a product is distributed by industry.	a. Film.
	b. Discussion - distribution of industry's products.

Objective: 4. To develop in each pupil a degree of skill in the safe use of tools and machines related to or used in conjunction with the study of the mass production manufacturing industry.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will be able to identify, select, and use tools and equipment needed for fabrication or production of this article to be manufactured.	a. Review material concerned with layout, cutting, shaping, forming, assembling, and finishing tools, devices, and techniques as deemed necessary.
	b. Discuss the use of jigs and fixtures. Show how those made in shop can be used successfully.
	c. Relate this to industry.
	d. Discuss newer tools and equipment used in industry.
	e. Assign report on development of tool or machine.
2. He will be able to define - tools, general and special purpose machines, jigs and fixtures.	a. Discussion.
	b. Demonstrate jigs and fixtures.
3. He will understand the meaning of jigs and fixtures and be able to design, construct and test jigs and fixtures.	a. Reading assignment.
4. He will know and use safely with a degree of skill most machines in the shop.	a. Review.
	b. Demonstrations.
	c. Study and information sheets.
	d. Safety check sheets.
5. He will be able to care for tools, equipment and facilities.	a. Show location and proper condition of tools or equipment. Insist on having tools returned to proper place.
	b. Provide a list of maintenance procedures for common tools. Have pupils perform simple maintenance and report items requiring more complex care to the instructor.

Objective: 4. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
5. (Continued)	c. Provide a maintenance check list for machines. Have pupil check and perform required procedures. d. Explain the function of the tool room in industry and the responsibilities of the workers with regard to its operations.
6. He will be aware of the policy of equipment, purchasing and replacement.	a. Discussion.

Approach:

1. Set up bulletin board display showing examples of mass production in industry.
2. Discuss the plan to donate the finished products to the underprivileged and handicapped at Christmas time.
3. Discuss with the pupil the features required in the article to be produced - functional, sturdy, safe, appealing.
4. Provide a film showing how a similar activity was carried on in the production of crawler tractors which will stimulate interest and increase comprehension of the factors involved.
5. Stress consideration of limitations concerned with job facilities, materials, time, pupil abilities, and cost, as well as overall practicality.
6. Provide recognition by means of securing publicity through contacts with local news media - television and newspaper. This is to be arranged by those pupils assigned to public relations and coordinated by the instructor.

Activities:

1. Have pupils select and design a product to be mass produced after discussing with them procedures which industry goes through and comparing them with those in the shop. Include limitations of the shop facilities, materials, pupil abilities, time, cost, learning experiences.
2. Have pupils develop drawings of the article selected.
3. Have pupils complete a materials list. Use procedures common to industry. Show materials catalogs and how suppliers list their products.
4. Develop with the pupils the principles of analyzing a sketch or drawing for details of construction and procedure. Stress logical sequence in construction activities.
5. Have pupils fabricate the article according to plan developed. Demonstrate the tool and machine processes involved, stress safety, principles involved, care for tools and machines and cooperation and regard for others.
6. Inspect and test article made, according to function, workmanship, marketability, and determine cost or probable selling price.

Suggested Texts:

Gerbracht, Carl and Robinson, Frank E. Understanding America's Industries. Bloomington, Ill.: McKnight and McKnight Publishing Company, 1962.

Haws, Robert W. and Schaefer, Carl J. Manufacturing in the School Shop. Chicago, Ill.: American Technical Society, 1960.

Resource Material:

George, Claude S. Management in Industry. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1959.

Keane, George R. Teaching Industry through Production. N.Y.: American Industrial Arts Association, 1959.

Keane, George R. Interpreting Industry through Line Production. G.S.T.C. I.A. Dept., Class '62, Resource Unit.

Keane, George R. Automation. Dearborn, Mich.: Research and Information Dept., Ford Motor Company.

Keane, George R. Industry and the American Economy - Series. N.Y.: National Association of Manufacturers, 1959.

Kettering, Charles Franklin and Orth, Allen. American Battle for Abundance. Detroit: General Motors, 1947.

Kettering, Charles Franklin and Orth, Allen. The Evolution of Mass Production. Dearborn, Mich.: Ford Motor Company, 1956.

Olson, Delmar W. Technology and Industrial Arts. Columbus, Ohio: Epsilon Pi Tau, Inc., 1957.

Vance, Stanley. American Industries. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1955.

Tools and Equipment:

Tools and equipment needed will be those found in a typical high school general shop. (See Appendix).

Materials and Supplies:

The materials list can be made available after a decision has been made on the article to be manufactured or produced.

Lessons to be Taught:

Manipulative Lessons

Since pupils participating in this unit may have had or have not had previous experience in industrial arts, those lessons needed to be taught concerning tools and equipment uses, etc., have been left for each teacher to determine. Only special manipulative lessons as indicated in the analysis of objectives have been mentioned.

1. How to design and construct a jig.
2. How to design and construct a fixture.
3. How to label a carton by the silk screen method.

Lessons to be Taught: (Continued)

Related Lessons:

This list was taken from the analysis of objectives and is in the nature of general statements of information to be taught rather than in specific titles. It should be noted that this list does not include films, discussions and other teaching methods suggested to achieve the behavior changes.

1. Three basic functions of industry.
2. Basic purpose of industry.
3. Automation.
4. Conservation and industry.
5. Organization of industry.
6. Occupational choice factors.
7. Personnel management.
8. Wages and prices, supply and demand.
9. Wages and reasons for differences among occupations.
10. Employee relations.
11. Role of organized labor.
12. Health and safety in industry.
13. Custom vs. mass production.
14. Research in industry.
15. Inventory control.
16. Work study and measurement.
17. Quality control and inspection.

Basic Concepts to teach concerning the line production techniques of mass production manufacturing

1. Management is the function that deals with getting things done through others. It (1) plans (2) organizes (3) staffs (4) directs (5) controls.

2. Types of ownership --

   (1) Proprietorship (2) Partnership (3) Corporation

3. Organization

   (1) Line organization

   (2) Line and staff organization

      a. Distinction between line and staff
      b. Managerial personnel duties
      c. Duties of all personnel

4. Most industrial enterprises are operated to make a profit by supplying a product or service at a time, place and price to induce consumer to buy.

5. Perform three basic functions:

    (1) Money to finance

    (2) Produce or assemble or acquire goods or service

    (3) Distribute product to consumer

6. Three principles that are fundamental to any organization:

    (1) Objective or purpose of organization

    (2) Delegation of authority facilitated by definite lines of supervision

    (3) Specialization of labor employed as much as possible

7. Importance of research

    (1) Reasons

        (a) Greater Projects

        (b) Survival - technologically superceded

    (2) Types

        (a) Pure

        (b) Applied

    (3) Functions of departments

        (a) Improve products)
) Product design and product research
        (b) Develop new products)

        (c) Protect patent position

        (d) Plan for future

        (e) Test produc

        (f) Give scientific advice

        (g) Evaluate diversification possibilities

        (h) Evaluate scientific markets

    (4) Market and motivation research

    (5) Planning a new product (steps)

        (a) Exploration

        (b) Screening

(5) Planning a new product (steps) (Continued)

(c) Specifications

(d) Development (Pilot model)

(e) Testing

(f) Commercialization

8. Standardization and industry and consumer

9. Simplification and industry and consumer

10. Specialization and industry

11. Plant location considerations

(1) Labor (most important single factor)
(2) Future plans
(3) Community attitudes
(4) Community facilities
(5) Nearness to market
(6) Transportation
(7) Power
(8) Water
(9) Community size
(10) Taxes and legislation
(11) Security
(12) Climate
(13) Land
(14) Industrial districts
(15) Housing and executor choice

12. Principles of building planning

13. Plant layout

(1) Objectives

(2) Types

(a) Process

(b) Product

(3) Considerations

14. Lighting, noise, plant climate, Importance of

15. Machine tools and processes

15. Machine tools and processes (Continued)
    (1) Tools
    (2) Machine tool - (General and special purpose)
    (3) Jig
    (4) Fixture
16. Automation - (feedback important)
17. Machine mechanization
18. Principles of materials handling
19. Importance of machinery maintenance
20. Equipment purchasing and replacement and policy
21. Employee relations - value of
22. Personnel management
23. Organized labor
24. Safety and health
25. Importance of work study
    (1) Motion studies
    (2) Time studies
    (3) Rules of motion
26. "We never find the best way".
27. Measuring work
28. Determining wages and payment plans
29. Budget control
30. Production control
31. Procuring materials
32. Inventory control
33. Inspection and quality control
34. Business statesmanship

Teaching Aids or Devices: (Suggested Ideas)

1. Information sheets
    - (1) The "steps" of Industry.
    - (2) The Seven M's of Manufacturing
    - (3) Stages of American Technology
    - (4) The History and Origin of Mass Production
    - (5) Mass Production - The Key to Abundance
    - (6) Parts to be Manufactured
    - (7) Jigs and Fixtures
    - (8) Assembly Flow Chart
    - (9) Fastening Devices
    - (10) Soldering: Solder and Flux
    - (11) Common Finishing Materials
    - (12) Notebook Requirements
2. Operation sheets
    - (1) Care and cleaning of a paint brush
3. Public relations

    (Optional)

    Could prepare a booklet or pamphlet that could be sent home to parents.
4. Film
    - (1) Interpreting Industry Through Line Production Processes

        Order from: Audio-Visual Center, Gorham State Teachers College
        Gorham, Maine

        Cost: Small handling charge

Evaluation Techniques:

1. Observe pupils as lessons are taught and as they work.
   (1) Do they hesitate?
   (2) Are they interested?
   (3) Are they eager?
   (4) Do they work safely?
   (5) Do they work efficiently?
   (6) Do they work cooperatively?
2. Question and answer periods.
   (1) Does everyone take part?
   (2) Do they answer correctly?
   (3) Do questions show interest and pertinency?
3. An Industrial Arts notebook will be maintained by each pupil.

   This notebook will be evaluated on the accuracy, completeness and arrangement of the following materials:

   (1) Notes on lectures and class discussions
   (2) Information and other sheets given out by the instructor
   (3) Written assignments and tests
   (4) Magazine articles and/or newspaper clipping dealing with new inventions, labor, new materials, and other topics pertinent to industry and industrial arts.
4. Written quizzes and tests.
   (1) Quizzes will be prepared and administered as required.
   (2) A mid-quarter test will be administered if deemed advisable.
   (3) A final examination will be administered upon completion of this unit.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavioral changes listed in the analysis of the objectives have been achieved.

Title of Unit: Manufacture of model power products (A Study of aerospace technology).

Introduction:

Perhaps nowhere in our whole industrial and technological complex have we made such significant and far-reaching advances as we have in the field of aerospace. How sophisticated are our problems of today, compared to those at Kitty Hawk in 1903!

Aerospace is the "youngster" of our power and transportation categories, yet here is an area that has tremendous implications in our quest for broader courses of study.

It is a field that can lead us in as many directions as the imagination can pursue. We can approach it from manufacturing or service with equal ease. It can incorporate production, power, transportation, electricity-electronics; sociology, economics, politics, geography; research and experimentation, projects, problem solving; mathematics, physics, chemistry, astronomy, meteorology; and of course international human relationships - perhaps some day "interworld" human relationships.

To exclude this aspect of technology from industrial arts is to deny "change" - precisely the same "change" that has created our society, and provided the position entitled "Industrial Arts Educator".

Welcome to Aerospace Education - and remember, "The sky is not the limit!"

Scope:

a. 9th grade

b. 8 - 9 weeks (suggested)

c. 200 - 275 minutes per week (min.)

Objectives

1. To develop in each pupil an understanding of the aerospace industries, and their scope and impact upon our modern civilization.

2. To develop in each pupil an awareness of the various occupations and their educational prerequisites in the aerospace field.

3. To explore and develop problem-solving abilities in the field of model astronautics through laboratory planning, research and experimentation, safety, testing and evaluation.

4. To develop in each pupil a degree of skill in working with the tools, machinery, and equipment related to the area of model astronautics.

Objective: 1. To develop in each pupil an understanding of the aerospace industries and their scope and impact upon our modern civilization.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize the significance of Aerospace Technology.	a. Unit overview. b. Current event reports. c. Starts organizing notebook.
2. He will become familiar with the principles and applications of Aerospace power.	a. Begins lab. activity (See Obj. 3). b. Observes and participates in lessons, demonstrations, and discussions on various phases of Aerospace power. c. Film - "The 707 Astrojet".
3. He will become acquainted with the types and applications of various Aerospace vehicles and basic principles of flight.	a. Assigned topics from unit bibliography materials. b. Observes and participates in lessons, demonstrations and discussions on aerospace vehicles and principles of flight. c. Films - "Spruce Budworm Spraying" "Flight 803" "The History of the Helicopter" "How an Airplane Flies"
4. He will recognize similarities and differences in manufacturing and productivity within the Aerospace industry as compared with other manufacturing industries.	a. Group discussions - Comparing methods of manufacturing and productive output of various industries. b. Display and discuss report on Aircraft production in Maine. c. Films - "The 720 Story" "Jet Test" "World on Wings"

Objective: 1. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
5. He will become aware of the socio-economic and political aspects of Aerospace technology.	a. Assigned readings and discussions over selected bibliography materials. b. Discussions: Civilian, military, and joint efforts in Aerospace technology. Possible topics include: 1. Commercial aviation. 2. The light plane industry. 3. Space development and research. 4. Offensive and defensive applications of aerospace.

Objective: 2. To develop in each pupil an awareness of the various occupations and their educational prerequisites in the aerospace field.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will become aware of the various occupational opportunities in the field of Aerospace.	a. Research into "individual interest" areas. b. Group and class discussions. c. Maintains section in notebook on occupations. d. Receives occupational data sheets.
2. He will recognize the importance of higher education in these areas and is aware of various institutions (civil and military) offering aero-space curricula.	a. Display educational materials available. b. Pupils bring in advertisements and training notices from magazines, newspapers, etc. for display. c. Discussion over occupational data sheets.

Objective: 3. To explore and develop problem-solving abilities in the field of model aero/astronautics through laboratory planning, research, experimentation, safety, testing and evaluation.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know basic principles of aero-astronautical design necessary for designing and constructing a working model aerospace vehicle. All information underlined must conform to NAR (National Association of Rocketry) Safety Standards.	a. Observes lessons and demonstrations in principles of rocket design and stability.
	b. Makes working drawings of model rocket.
	c. Begins model rocket construction.
	d. Maintains all data in experiment sheet form.
2. He will know principles of model rocket power for flight.	a. Observes lessons and demonstrations in model rocket engines and their safe ignition.
	b. Applies these principles in lab and field work. Keeps records.
3. He will know principles involved in model rocket launching.	a. Observes lessons and demonstrations, in model rocket launching.
	b. Applies these principles in field activity. Keeps records.
4. He will know principles of model rocket tracking.	a. Observes lesson in rocket tracking.
	b. Interprets tracking data sheets.
	c. Applies these principles in follow-up of launching. Collects data and records.
5. He will know principles of model rocket recovery.	a. Studies and discusses types of rocket recovery.
	b. Applies one or more of these methods in rocket activity.
	c. Collects data and records.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. He will recognize the significance of this activity.	a. Class studies and reviews all data on testing, experimenting and flying these models. Evaluates and formulates conclusions.

Objective: 4. To develop in each pupil a degree of skill in working with the tools, machinery and equipment related to the field of model astronautics.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will display competence in the proper care and use of drawing instruments and equipment.	a. Observes lessons and demonstrations in principles and techniques of drafting. b. Applies this knowledge in lab activity (See Objective 3).
2. He will exhibit reasonable ability, craftsmanship, and understanding of modeling techniques while working with typical modeling materials in the following sequence: a. selecting stock b. laying out stock c. cutting d. shaping e. forming f. assembling g. finishing	a. Observes demonstrations in model building techniques. b. Applies these techniques to model rocket construction. Specific skills should be developed within the sequence listed under behavior change #2.

Approach:

The most effective approach to this unit is to demonstrate to the class an actual model rocket launching in the field. Please note, however, that prior to this demonstration a lesson on field safety must be given. Model rockets are no more dangerous than any of the equipment and machinery in the industrial arts laboratory; comparable results may be expected, therefore, due to carelessness while operating the circular saw - or lack of common sense while working around "live" model rockets of four to five hundred miles per hour capabilities.

Activities:

1. Have pupils select and design a model power product after discussing with them procedures which industry goes through and comparing them with those in the shop. Include limitations of the shop facilities, materials, pupil abilities, time, cost, learning experiences.
2. Have pupils develop drawings of the article selected.
3. Have pupils complete a materials list.
4. Develop with the pupils the principles of analyzing a sketch or drawing for details of construction and procedure.
5. Have pupil fabricate the article according to plan developed.
6. Inspect and test article made, according to function, workmanship, etc.

Resource Materials:

Civil Air Patrol. Aviation Study Manual, Vol. I Bk. II. Civil Air Patrol, Washington, D. C., 1949.

Ley, Willy. Rockets, Missiles, and Space Travel. The Viking Press, New York, 1951. (newer ed. available).

Stephenson, G. E. Power Mechanics. (Text) Delmar Publishers, Inc., Albany 5, N. Y., 1963.

1964 Aircraft, missiles and Spacecraft, $2.00 ea., and

Aviation Education Bibliography, Fourth Ed., May, 1964, $.25 ea.
(An excellent listing of books, references, periodicals, films, filmstrips, and teaching aids). Both available from:

National Aerospace Education Council
1025 Connecticut Ave., N. W.
Washington, D. C. 20036

Model Rocket Supplies: - Order from:

Estes Industries, Inc.
Box 227, Penrose, Colo. 81240
(catalog #641 available for $.25 each)

Tools and Equipment:

No special tools or equipment are needed to carry out a model rocket activity other than those normally found in the school shop. Certain instructors will have had more modeling experience than others and will, by preference, choose certain tools which they have found worked best for them.

Materials and Supplies:

1. Model rocket engines - 1/4 to 1/2 A. 8-2 or equivalent.
2. Body tubes - commercially prepared or paper towel rolls, etc.
3. Balsa wood
    a. Nose cones - approx. 3/4 to 1 5/8 square before turning.
    b. Sheet for fins - 1/16 to 1/8
4. Parachute materials (must be lightweight)
    a. sheet polyethylene plastic or silk
    b. heavy thread (smooth surface)
5. Rubber shock cord (rubber bands - 1/32 x 1/8 cut one end ok)
6. Small screw eyes
   (for information on above materials see Estes Industries - listed in Unit Resource Materials)
7. Nichrome wire - #30 - 32.
8. X-Acto knives or single edge razor blades.
9. Small brushes
10. Sanding sealer ("Bin" works well)
11. Lacquer - various colors
12. Masking tape; scotch tape
13. Fine abrasive paper
14. Model cement or white glue
15. Box soda straws (for launching lugs)
16. Box tissue (for packing igniter into engine)
17. Fireproof packing - batt insulation or similar
18. Welding rod or spring wire - 1/8" dia. x 3' - for launching rod
19. Can talcum powder (lubricates parachute and packing)
20. 6 or 12 volt auto battery (for best ignition)

Lessons to be Taught:

These are suggested lessons which may be taught in this unit. Depending upon class background and unit directions, these will vary accordingly. The aerospace field is so very broad that the directions this unit may take are largely up to the instructor as long as these variations are within the framework of the stated objectives.

1. Introduction to aerospace (Unit Overview).
2. Systems common to heat (internal combustion) engines.
3. How to draw straight lines, circles and arcs with common drafting instruments (lesson series).
4. How to stabilize a model rocket.
5. Jet engine principles; rocket engine principles.
6. Model building techniques - may be a series, set up as: select stock, layout, cut, shape, form, assemble, finish.
7. How to layout simple multi-view drawings.
8. How to dimension simple multi-view drawings.
9. Lift and forces in flight.
10. Airplane controls and how they work.
11. Principles of space travel.
12. Model rocket mathematics.
13. Aircraft manufacturing techniques.
14. Commercial aviation.
15. The light plane industry and private flying.
16. Satellites for space development and research.
17. Military aspects of aerospace technology.
18. Occupational opportunities in aerospace.
19. Other model rocket lessons.
    a. model rocket engines.
    b. model rocket launching.
    c. model rocket tracking.
    d. model rocket recovery.

Teaching Aids or Devices: (Suggested Ideas)

1. Information sheets
    1. Specimen drawing layout sheet
    2. Rocket design ideas - sheet
    3. Drawing - lines, letters and numbers
    4. Model rocket engines
    5. Jet engine principles
        a. Ram jet
        b. Pulse jet
        c. Turbo jet
        d. Turbo prop
        e. Turbo fan

    6. Lift and forces in flight
    7. Airplane controls
    8. Model rocket tracking data sheets
    9. Occupational data sheets

Teaching Aids or Devices: (Continued)

II. Activity sheets
    1. Personnel organization sheets or chart
    2. Flight data sheets

III. Films - Aircraft manufacturing
    1. "Jet Test" #SEP 266 B/W, 14½ min. free loan
        Air Force Film Library
        8900 S. Broadway
        St. Louis, Mo. 63125

    2. "The 720 Story" Color, 24 min. free loan.
        The Boeing Company, Film Editor
        News Bureau, P. O. Box 3707
        M. S. 16-41, Seattle 24, Wash.

    3. "World on Wings" Color, 20 min. free loan.
        Cessna Aircraft Company
        Box 1521, Wichita, Kansas

Films - Airline operation, Air transportation, Air cargo
    1. "Flight 803" #1695 color, 26 min. free loan
        Modern Talking Pictures Service, Inc.
        3 East 54th St., New York 22, N.Y.

Aviation history
    1. "The History of the Helicopter" B/W 20 min. free loan
        Shell Oil Company
        149-07 Northern Blvd., Flushing 54, N. Y.

Jet Engines
    1. "The 707 Astrojet" Color, 13 min. free loan
        American Airlines, Public Relations
        633 Third Ave., New York 17, N. Y.

Principles of Flight
    1. "How an Airplane Flies" #TF1-4805 B/W, 34 min. free loan
        Airforce Film Library
        8900 So. Broadway, St. Louis, Mo. 63125

Aviation uses
    1. "Spruce Budworm Spraying" Color, silent, 20 min. free loan
        Maine Forest Service, c/o Mr. Robley Nash
        State Office Bldg.
        Augusta, Maine

IV. Teaching Devices
    1. Working model rocket for demonstration
    2. Model airplane
    3. "Glass Box" principle - multiview drawing device

Evaluation Techniques:

Grading Items

1. Required notebook
2. Activity packet - to include
    a. drawings.
    b. model rocket construction data.
    c. model rocket pre-flight testing data.
    d. model rocket flight test data.
    e. Summary, evaluation and conclusions.

3. Quizzes and examination
4. Oral and/or written reports
5. Contribution to class discussion and/or activity
6. Extra credit and make-up work.
    a. oral reports.
    b. written reports.
    c. book reports.
    d. model rocket designs.
    e. posters.
    f. construction of model aerospace vehicle(s).

7. Observed behavior during class activity; safety
8. Model (project evaluation)
    a. design; function.
    b. stability.
    c. performance.
    d. craftsmanship and detail.
    e. overall appearance

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavioral changes listed in the analysis of the objectives have been accomplished.

Manufacturing
and
Construction
Industries
Grade 10

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Title of Unit: Manufacture of Small Tools and Machines (A study of a manufacturing industry)

Introduction:

As industrialization progressed through the nineteenth century and into the twentieth, industries had increasing difficulty in designing and making their own production tools and machines. The manufacture of such items soon became an important industry. This type of production is reputed to be the most difficult to automatize because of the nature of the processes involved. The tools and machines category includes the production of all tools, machines, and equipment used in other manufacturing and service industries, and includes much more than the recognized machine-tool industry. Because of the nature of the production, the tools and machines industries depend largely on skilled craftsmen using machine tools for the construction of their products. Precision is essential, and much scientific study, experimentation, invention, and designing is required to develop new machines for new processes and for new materials.[1]

[1] Olson, Delmar W. Industrial Arts and Technology. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963, p. 126.

Scope:

a. 10th grade

b. 12 - 15 weeks (suggested)

c. 200 - 275 minutes per week (min.)

Objectives

1. To develop in each pupil an insight into and understanding of the small tool and machine industry and its place in our society.

2. To discover and develop pupil interests and talents in the small tool and machine industry.

3. To develop in each pupil problem-solving abilities related to the materials, processes and products of the small tool and machine industry.

4. To develop in each pupil a degree of skill in the safe use of tools and machines needed to manufacture a small tool or a machine.

Objective: **1. To develop in each pupil an insight into and understanding of the small tool and machine industry and its place in our society.**

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know the variety and sizes of various small tool and machine industries.	a. Show an exhibit of small tools and machines produced by various manufacturers.
	b. Lesson on the importance of the small tool and machine industry.
	c. Discussion on the various types of tools and machines produced by this industry.
2. He will be aware of the important role that the small tool and machine industry plays in our present society.	a. Lesson on importance of this industry to other manufacturing and service industries.
	b. Discussion on how this industry depends largely upon skilled craftsmen in the construction of the product.
3. He will recognize the place of research and development in the small tool and machine industry.	a. Lesson on the importance of research, experimentation and designing for the development of new machines for new processes and materials.
	b. Compare articles of different years and point out the effects of research and development on the design of the product.

Objective: 2. To discover and develop pupil interests and talents in the small tool and machine industry.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a knowledge of the variety of opportunities in the line and staff organization of a small tool and machine industry. Suggested fields are: Sales Design engineering Methods engineering Tool design Cost accounting Materials control Production control Personnel Maintenance Quality control Finance	a. Information sheets. b. Discuss with the class the requirements for entering the various fields in a manufacturing line and staff organization. c. Invite speaker from a manufacturing industry that is involved in managerial duties.
2. He will have a knowledge of the variety of opportunities in the production area of the small tool and machine industry. Suggested fields are: Patternmaking Foundry work Machining Wood parts production Heating treating & hardening Forging Welding-arc & oxy-acetylene	a. Information sheets. b. Show occupational films on these various trades. c. Bulletin board - "Various occupations in the Production Department of a Small Tool and Machine Industry". d. Have pupil prepare a guidance folder covering the various production jobs in this industry.

Objective: 3. To develop in each pupil problem-solving abilities related to the materials, processes and products of the small tool and machine industry.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize good design and apply such knowledge in the construction of a tool or a small machine.	a. Discussion of the principles of good design. (Review)
	b. Have pupil prepare a notebook or chart to show good and bad types of design for various tools and machines in common use.
2. He will re-design a tool or a small machine to improve the appearance and utility.	a. Require pupil to design or re-design a tool or a small machine.
	b. Lesson on styling.
	c. Establish an award system for the best design in class.
	d. Lesson on how the development of new materials and machines has made possible changes and improvements in design.
3. He will make working sketches or drawings of a tool or a small machine.	a. Lesson on sketching techniques.
	b. Have pupil sketch or draw a tool or a small machine.
4. He will think through the correct procedure for making a tool or machine.	a. Demonstrate the method of preparing a plan sheet.
	b. Require all pupils to submit plan sheets with the procedure outlined before permitting them to start work.
	c. Stress the importance of planning.
5. He will analyze drawings or sketches for materials needed.	a. Review with pupil method of recording materials.
	b. Have pupil make materials list of items needed to manufacture a tool or a small machine.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. He will analyze drawings or sketches for procedure of construction.	a. Lesson on steps or procedures needed in manufacturing a tool or a small machine.
	b. Have pupil complete a job or plan sheet (operation and route sheet) for the construction of a tool or a small machine.
7. He will recognize and/or obtain materials selected.	a. Discuss with the class the properties, limitations and characteristics of woods, metals and plastics that are used in the manufacture of small tools and machines.
8. He will use labeling techniques on the produced article.	a. Lesson on how industry labels products.
	b. Lesson on what's in a label or brand name.
9. He will use pricing and packaging techniques on the produced article.	a. Discussion on how a product is priced.
	b. Lesson on the importance of packaging in industry.
10. He will recognize quality and craftsmanship in the tool or machine that was manufactured.	a. Lesson on inspections and quality control.

Objective: 4. To develop in each pupil a degree of skill in the safe use of tools and machines needed to manufacture a small tool or a machine.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use layout, cutting, forming, shaping, holding, assembly and finishing tools and procedures.	a. Lessons over those layout, cutting, forming, shaping, holding, assembly and finishing tools needed for the construction of a tool or machine. b. Have pupil locate and name the layout, cutting, forming, shaping, holding, assembly and finishing tools he will use.
2. He will become familiar with the different types of machines in the industrial arts laboratory.	a. Demonstrate the use of machines in the industrial arts laboratory. b. Require pupil to sign check list on all machines that have been demonstrated to pupil by instructor. c. Have pupil correctly identify the major parts of the machines.
3. He will better understand the similarity between machines in the industrial arts laboratory and those used in industry.	a. Have pupil explain how these basic machines are used in making all other machines. b. Have pupil compare the machines used in the industrial arts laboratory with those used by the small tool and machine industry.
4. He will select and use machines and procedures.	a. Lessons over machines needed in the construction of a tool or a machine. b. Have pupil demonstrate safe operation of machines he will use.
5. He will gain knowledge of the safety factors common to each individual piece of equipment in the shop.	a. Prepare safety signs and bulletin board displays. b. Assign reports on "Accidents Can Be Prevented", or a similar theme.

Objective: 4. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. He will become more aware of the safety programs carried on in industrial plants today.	a. Arrange for safety engineer or local plant safety representative to speak to class. b. Arrange for safety engineer or committee for shop and line production activities.
7. He will participate actively in the safety program of the school's industrial arts laboratory.	a. Have periodic tests over safety standards in the laboratory. b. Have pupil take permit slips to parents for signature. c. Have pupil work with instructor to organize and set up a shop safety program.

Approach:

1. Give pupils examples of well designed, versatile tools or machines-Example, "Shopsmith".
2. Plan a field trip to a local small tool and machine industry; give each pupil a separate item to inquire about and report about this item during class discussion.
3. Show a training film about the small tool and machine industry.
4. Have the pupils as a group compile a list of machines and tools that could be produced in the industrial arts laboratory.

Activities:

1. Have pupils select and design a small tool or machine after discussing with them procedures which industry goes through and comparing them with those in the shop. Include limitations of the shop facilities, materials, pupil abilities, time, cost, learning experiences.
2. Have pupils develop drawings of the article selected.
3. Have pupils complete a materials list. Use procedures common to industry. Show materials catalogs and how suppliers list their products.
4. Develop with the pupils the principles of analyzing a sketch or drawing for details of construction and procedure. Stress logical sequence in construction activities.
5. Have pupils fabricate the article according to plan developed. Demonstrate the tool and machine processes involved, stress safety, principles involved, care for tools and machines and cooperation and regard for others.
6. Inspect and test article made, according to function, workmanship, marketability, and determine cost or probable selling price.
7. Optional - operate a mass production project and produce a tool or a machine.
8. Optional - study a primary industry that produces materials that are used in the manufacture of small tools and machines.

Suggested Texts:

Feirer, John L. Woodworking for Industry. Peoria, Illinois: Chas A. Bennett Co., Inc., 1963.

Johnson, Harold V. General-Industrial Machine Shop. Peoria, Illinois: Chas. A. Bennett Co., Inc., 1963.

Ludwig, Oswald A. Metalwork Technology and Practice. Bloomington, Illinois: McKnight and McKnight Publishing Co., 1962.

Resource Materials:

Adams, Walter. The Structure of American Industry. New York: The MacMillan Co., 1954.

Gerbracht, Carl and Robinson, Frank. Understanding American Industry. Bloomington, Illinois: McKnight and McKnight Publishing Co., Inc.

Rusinoff, M. E. Manufacturing Processes - Materials and Production. Chicago, Illinois: American Technical Society, 1962.

Vance, Stanley. American Industries. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1955.

Tools and Equipment:

Tools and equipment needed will be those found in a typical high school general shop. (See Appendix)

Materials and Supplies:

Drawing paper; drawing pencils; erasers; desk supplies (tacks, paper clips, glue, magic marker, etc.); poster paper; sand paper; steel wool; various wood finishes; glue; nails, screws and other fasteners; plastic wood; dowels (assorted sizes); rags; wax; oil; abrasive cloth; layout dye; assorted machine screws; assorted allen set screws; assorted cap screws; assorted cotter pins; assorted washers; welding and brazing rods; flux; various metal finishes; solder; heat treating compounds; cutting oils; lapping compound; tungsten carboloy tool bits; woods (pine, maple, oak, ash, plywood, masonite); plastics (sheet-various colors and thickness, preformed bars for tool handles, bars, rods); metals (bar-hot and cold rolled steel, rod-hot and cold rolled steel, drill rod, brass rod, aluminum rod, aluminum bar, sheet metals, ingot metal, steel plate, band iron, angle iron, channel iron, billet cast iron).

Lessons to be Taught:

This list of lessons was taken from the analysis of objectives.

Since the use of a variety of materials is encouraged but may not be practical in every instance, it would be more logical for manipulative lessons to be selected by the individual teacher to follow the general engineering and manufacturing procedures used by industry to produce its products rather than by categories such as woodworking, metalworking, etc.

Manipulative lessons then will fall into the following categories.

1. Engineering
    - Idea
    - Design
    - Sketching
    - Drawing
    - Materials list
    - Procedures of manufacture

Lessons to be taught:

Manipulative Lessons: (Continued)

2. Manufacture
   (Concerned only with those tools needed in production of a tool or machine. Listing of tools found in the Appendix)

   A. Layout, cutting, forming, shaping, holding, assembly and finishing tools and procedures should include:

      1. Recognize and select
      2. Name correctly
      3. Use properly and safely (To extent needed in manufacturing of product)

   B. Machines and procedures should include:

      1. Name correctly
      2. Use properly and safely (To extent needed in manufacturing of product)

Related Lessons:

This list of lessons was taken from the analysis of objectives and is in the nature of general statements of information needed to be taught rather than specific titles. It should be noted that this list does not include films, discussions and other teaching methods suggested to achieve the behaviour changes.

1. Importance of the small tool and machine industry.
2. Importance of this industry to other manufacturing and service industries.
3. Importance of research, experimentation and designing for the development of new machines for new processes and materials.
4. Various occupations found in the small tool and machine industry.
5. Principles of design (review).
6. Styling.
7. Effects of new materials and machines on designing products.
8. Sketching and drawing a small tool or a machine.
9. Characteristics of the various materials used in the manufacture of a small tool or machine.
10. Inspecting and evaluating a finished product.
11. Labeling and packaging procedures used by industry.
12. Pricing and distributing a finished product.
13. Quality of workmanship and standards in manufactured products.

Teaching Aids or Devices: (Suggested Ideas)

1. Chart showing various types of small tools and machines.
2. Copies of Mechanics Illustrated, Popular Science, Home Craftsman, etc.
3. Samples of small tools and machines.
4. Chart showing occupations, pay scales, job requirements within the small tool and machine industry.

Teaching Aids or Devices: (Suggested Ideas)-Continued

5. Samples of good and poor design.
6. Film "Shopsmith" by Sears, Roebuck and Co.
7. Samples of materials, new and old.
8. Chalkboard.
9. Bulletin board.
10. Sample plan sheet, job sheets, bill of materials.
11. Consumer report, catalogs, price lists, etc.
12. Film on research and development in small tools and machine industry.
13. Film on shop and industrial safety.
14. Safety test and parental approval form.
15. Charts or posters on various machines.

Evaluation Techniques:

1. Observation.
2. Performance test.
3. Safety test.
4. Class discussion.
5. True and false tests.
6. Multiple choice tests.
7. Assignments and reports.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavior changes listed in the analysis of the objectives have been accomplished.

Title of Unit: Residential Construction

Introduction:

The residential construction industry occupies a major part of the construction industries in America. Evidence of this is recognized in the mass move to suburbia. This phase of the construction industry utilizes a wide variety of materials and requires workers with a knowledge of assembly and construction operations, and varying levels of abilities and skills. Residential structure construction calls for engineers, architects, journeymen, tenders and laborers.

A study of this phase of the construction industry is important to the youth at this grade level, in view of the direction it may give them in future vocational choices. For those who have an interest in architectural drawing or engineering, it will help give an insight to their function and requirements. On the other hand, those who are not college bound may find such a study leading to more specific preparation, such as a vocational school or apprenticeship program.

Scope:

a. 10th grade

b. 18 - 20 weeks

c. 200-275 minutes per week (min.)

Objectives

1. To develop in each pupil an insight into and understanding of the residential construction industry and its place in our society.

2. To discover and develop in each pupil interests and talents in the field of residential construction.

3. To develop in each pupil problem-solving abilities and understandings related to the materials, processes and products of the residential construction industry.

4. To develop in each pupil a degree of skill in the safe use of tools and machines common to the residential construction industry.

Objective: 1. To develop in each pupil an insight into and understanding of the residential construction industry and its place in our society.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know the scope, size, variety and place of the residential construction industry in the United States.	a. Lesson-"The Residential Construction Industry".
	b. Bulletin Board display-"The Construction Industry".
	c. Notebook for the unit.
2. He will realize the importance of the residential construction industry to the health and well being of all people.	a. Have the pupil bring in news items about residential construction projects and discuss their effects on our health and well-being.
	b. Have the pupil trace the development of housing from pre-historic times to the present. Discuss the effects of these developments on our society.
3. He will know the effects of seasonal or climatic conditions on the residential construction industry.	a. Investigate the varying climatic conditions within the state and country.
	b. Discuss the effects of varying climatic conditions on employment, materials, processes and other elements in the residential construction industry.
4. He will become familiar with those industries allied with the residential construction industry.	a. Have the pupil list the different types of local industries that are engaged in residential construction.
	b. Discuss the interdependencies that exist among the industries.
5. He will have a knowledge of the socio-economic aspects of the residential construction industry.	a. Discuss social factors concerned with choosing the location for a home as to the area, neighbors, etc.
	b. Discuss low-cost housing and urban renewal and the role of the residential construction industry in these projects.

Objectives: 1. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
5. (Continued)	c. Invite a speaker from Urban Renewal Commission to speak on the importance of residential construction industry to the economic growth of the state and city. d. Assigned report on the government's activities in public housing. e. Invite a speaker from Savings and Loan Association to speak on types, methods, and requirements for obtaining a loan for house construction. f. Have pupil write a report on borrowing for house construction.

Objective: 2. To discover and develop in each pupil interests and talents in the field of residential construction.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a knowledge of the variety of opportunities in the residential construction industry. Suggested fields are: Architectural drafting Carpentry and millwork Masonry Concrete work Plumbing and heating Plastering Painting	a. Information sheets.
	b. Assignment sheet--explore an occupation of pupil's choice.
	c. Discuss relation of occupations to the experiences to be gained in the laboratory.
	d. Invite speaker from the Maine Employment Security Commission.
	e. Show occupational films on residential construction and educational requirements for the worker.
2. He will have a knowledge of requirements and occupational choice factors to consider in selecting an occupation.	a. Invite a local contractor to discuss his work and requirements for success.
	b. Assign readings on occupations in guidance bulletins, government reports, etc.
	c. Have the pupil make a list of personal qualities desired of a worker in the industry and discuss the same.
3. He will realize the role unions play in the residential construction industry.	a. Have pupil investigate and discuss the number and types of unions involved in the construction of residences.
	b. Use a local union president as a resource person to discuss the importance of unions to the worker.
	c. Bring in a set of union rules and discuss these with the pupils.

Objective: 3. To develop in each pupil problem-solving abilities and understandings related to the materials, processes and products of the residential construction industry.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a basic understanding of the principles of planning and design related to residential construction and will be able to apply them in a practical situation.	a. Show aerial photographs, topographical maps, plot plans, and a deed and discuss their application in preliminary planning. b. Illustrate plot layout with a transit, compass, deed, target, plumb bob, tape, chalk line and framing square. c. Assigned readings. d. Discuss location and site selection. e. Discuss building code and zoning requirements. f. Invite a surveyor or city engineer to speak on plot planning and land development. g. Invite an architect to speak on home planning. h. Show films on home planning. i. Information sheets on making preliminary designs. j. Apply principles of planning and design to the development of a small construction product such as: 1. Storage building for lawn and garden tools. 2. Child's play house (scaled from full size). 3. Camp--"A" frame or standard construction. k. Make preliminary planning and design sketches.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
2. He will have a basic knowledge of architectural styles and types of structures in residential construction.	a. Lesson - architectural styles. b. Study sheet. c. Bulletin board display--different styles of homes. d. Discuss types and advantages of wood, steel and aluminum frame construction, including pre-fabs. e. Assign pupils to get pictures of the different popular house styles. f. Written assignment--report about the type and style of home the pupil would select for his present family and why he selected it. g. Discussion--what style of building should be built by the class considering all factors involved, cost, time, etc.
3. He will become familiar with the variety of materials used in residential construction, how they are used, and the industries producing them.	a. Lesson--woods used in construction. b. Bulletin board--samples of wood and the lumbering industry and wood products. c. Reading assignments. d. Testing wood and wood products for design purposes. e. Lesson--metals used in construction. f. Bulletin board display--metal samples and the metal industry. g. Reading assignments. h. Film. i. Lesson--roofing and siding materials.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
3. (Continued)	j. Films--outside materials. k. Lesson--masonry materials used in residential construction. l. Lesson--ceramic materials used in residential construction (excluding masonry; including glass, plaster, etc.) m.. Have pupil send for manufacturer's bulletins on different kinds of home covering materials. n. Pupil reports on house covering products.
4. He will have a general technical understanding of architectural drafting in the construction industry.	a. Lesson--scope and considerations in architectural drafting--overview.
5. He will be aware of the elements to be found in the field of architecture.	a. Lesson--elements in the field of architecture: Design Engineering Materials Planning Presentations Specifications
6. He will be aware of the construction elements to consider in a study of residential construction.	a. Lesson--construction elements for consideration: Air conditioning Carpentry Communications Decoration Earth moving Electrical Flooring Furnishings Heating

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. (Continued)	a. (Continued) Masonry Lighting Refrigeration Roofing Sanitation Structures Transportation (driveway, etc.)
7. He will be able to apply principles of design, considerations of materials, and construction elements and processes with a knowledge of architectural drafting to produce a complete set of plans.	a. Lessons, study sheets, sample blueprints, discussions, reading assignments, etc., and activities to cover: sheet layouts and title blocks architectural lettering plan conventions first floor plan basement plan elevations house parts and details footings and foundation walls sill construction framing roofs and cornices windows stairs entrances and doors fireplaces plumbing electrical wall sections
	b. Lesson--how to use templates, drafting machines and other instruments and materials common to the architectural drafting field.
	c. Examine and discuss sample house plans.
	d. Construct model of building the class will be constructing. Discuss its function, design, etc.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
8. He will have a basic knowledge of how to estimate building materials for a home.	a. Lesson--estimating. b. Estimate materials needed, and prepare a bid.
9. He will be able to do basic blueprint reading.	a. Lesson--blueprint reading. b. Blueprint reading problems.
10. He will know the meanings of related terms.	a. Terminology sheet.
11. He will understand the importance and reason for specifications.	a. Lesson--specifications. b. Show and discuss sample specification c. Prepare a specification booklet on building to be constructed.
12. He will have a basic understanding of regional variations in house construction.	a. Lesson--regional variations in house construction. b. Study sheet--variations in construction.
13. He will have an awareness of home construction trends.	a. Lesson--trends in home construction.
14. He will be able to recognize, understand, and use the principles of foundation construction.	a. Lesson--how to locate, layout, and use batter boards. b. Study sheet--types of foundations and advantages of each. c. Discussion--depth of foundation below grade and height of walls, and thickness of walls, floors, sidewalks and driveways, cost of excavating and methods. d. Discuss various concrete mixes and types of aggregates. e. Lesson--form building.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
14. (Continued)	f. Pupil layout, build forms, mix concrete and pour foundation for building.
	g. Reports on concrete and other forms of foundation walls.
	h. Visitation to a cement plant.
15. He will be able to recognize, understand and use the principles of wall and floor rough framing.	a. Lesson-types of wall framing.
	b. Lesson-how to frame walls, floor, and openings for windows and doors.
	c. Reading assignment-"Techniques of House nailing".
	d. Frame wall and floor and lay sub-floor of building being constructed.
16. He will be able to recognize, understand and use the principles of foundation construction.	a. Study sheet-types of roofs.
	b. Lesson-principles of roof framing.
	c. Study sheet-types of rafters.
	d. Lesson-how to layout and cut the common rafter.
	e. Study sheet-trusses and their uses.
	f. Roof framing problems.
	g. Frame the roof of the building being constructed.
17. He will be able to recognize, understand and use the principles of exterior finish.	a. Lesson-how to sheath a building.
	b. Sheath building being constructed.
	c. Lesson-constructing and setting exterior window and door frames.
	d. Lesson-how to put on roof covering materials.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
17. (Continued)	e. Lesson-how to build cornices and gable trim.
	f. Lesson-gutters and how to install them.
	g. Lesson-wall sidings and how to install them.
	h. Complete exterior finish of building.
18. He will be able to recognize, understand, and use the principles of interior finish.	a. Lesson-installing windows and doors.
	b. Lesson-how to apply insulation and interior wall coverings.
	c. Lesson-floorings and how to apply them.
	d. Discussion-interior covering materials.
	e. Lesson-how to install interior trim and types of trim available.
	f. Lesson-electrical and plumbing considerations for the carpenter.
	g. Finish off the interior of the building.
	h. Lesson-how to layout and install straight run stairs.
	i. Study sheet-types of stairs.
	j. Lesson-cabinet and built-in construction.
	k. Construct stairs and built-ins.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
19. He will be able to recognize, understand and use the principles of interior decoration.	a. Discuss some of the principles of interior decoration and furnishing. b. Develop a notebook section on interior decoration, design and color. c. Plan a home workshop. d. Plan and decorate a room at home. e. Plan suitable interior decoration plan for building being constructed.
20. He will be able to recognize, understand and use the principles of exterior decoration.	a. Discuss principles of landscaping around the home. b. Plan the landscape around a selected home.
21. He will have a knowledge and understanding of basic considerations involved in buying a home.	a. Discussion-buying a home.
22. He will have a knowledge and understanding of things to consider when engaging someone else to build his home.	a. Study sheet-factors to consider when building a home. b. Invite a contractor to speak to the class on securing his services to build a home, the contract, etc.
23. He will have a basic knowledge of brick masonry--description, brick manufacture, kinds, uses, mortar,etc.	a. Lesson-introduction to brick masonry.
24. He will be able to do elementary brick laying.	a. Lesson-how to lay brick walls. b. Study sheet. c. Do brick work on a chimney or fireplace.
25. He will have a basic understanding of fireplace design.	a. Study sheet.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
26. He will have a basic understanding of chimney construction and design.	a. Study sheet.
27. He will have a very basic understanding of heating systems in the home; types, designs, etc.	a. Lesson-home heating systems.
28. He will be aware of major considerations relative to heat loss.	a. Lesson-how to figure heat loss. b. Problems.
29. He will have a very basic understanding of plumbing as it applies to residential construction.	a. Lesson-introduction to plumbing. b. Talk by a local plumber.
30. He will have a very basic understanding of the principles in plumbing system planning--sanitary system and water system.	a. Information sheet-elements in plumbing system planning. b. Plan a system for building being constructed.
31. He will be able to do simple pipe fitting and tubing fitting.	a. Lesson-how to do simple pipe and tubing fitting. b. Construct and install plumbing in building being constructed.
32. He will have a very basic understanding of plastering as it applies to residential construction.	a. Lesson-plastering; how it is done. b. Apply plaster to section of building.
33. He will have a knowledge and understanding of painting as applied in the field of residential construction.	a. Lesson-house painting; methods and techniques (basic). b. Apply finishing materials to building being constructed.

Objective: 4. **To develop in each pupil a degree of skill in the safe use of tools and machines common to the residential construction industry.**

Expected pupil behavioral change	Suggested activities to implement the change
1. **He will have a basic knowledge and understanding of the kinds of hand tools used in the carpentry trade and will have developed a degree of skill in their safe use and selection.**	a. **Lessons, study sheets, films, etc., over:** **Layout and measuring tools** **Cutting and boring tools** **Supporting and holding tools** **Percussion and impelling tools** **Devices made on the job** **Special tools** b. **Pupil will use carpentry tools in construction of building.**
2. **He will have a basic knowledge and understanding of the kinds of power tools used in the carpentry trade and will have developed a degree of skill in their safe use and selection.**	a. **Lessons, study sheets, films, etc., over:** (Partial list only) Portable sanders Portable power hand saws Portable electric routers Portable electric drills Portable electric planes Circular table saw Planer Jointer, etc. b. **Pupil will use power tools in construction.**
3. **He will realize the importance of the care of tools and machines related to or used in the field of residential construction.**	a. **Discussion on care of tools and equipment.** b. **Pupil will care for tools being used.**
4. He will have a basic knowledge and understanding of the kinds of tools used in plumbing and will have developed a degree of skill in the safe use of the common tools and their selection.	a. **Lesson-plumbing tools and equipment and how they are used.** b. **Pupil will use plumbing tools and equipment in installation of plumbing in building.**
5. **He will have a basic knowledge and understanding of the kinds of tools used in concrete and masonry work and will have developed a degree of skill in their safe use and selection.**	a. **Lesson-concrete and masonry tools and equipment and how they are used.** b. **Pupil will use concrete and masonry tools in construction of building.**

Objective: 4. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. He will have a basic knowledge and understanding of the kinds of tools used in plastering and will have developed a degree of skill in their safe use.	a. Lesson–plastering tools and how they are used. b. Pupil will have opportunity to plaster wall of building.
7. He will have a basic knowledge and understanding of kinds of tools and equipment used by the house painter and will have developed a degree of skill in their safe use and selection.	a. Lesson–painting equipment and its proper use. b. Pupil will participate in the painting of the building being constructed.

Approach:

1. Field trip to a local building project.

2. Movies to motivate

   Suggested films:

   "Building Techniques"
   "The Carpenter"
   "Framing"
   "Elements of Design"
   "Introduction to Architecture"

   These films may be obtained from:

   Film Center
   University of Washington
   Seattle 5, Wash.

3. Slides to motivate.

4. Panel discussion.

5. Start a group discussion.

Activities:

The principal activity for this unit is the designing, planning and construction of a building made of full size construction materials. This building should as much as possible involve the following fields of construction and fields related to them: architecture, carpentry, concrete and masonry, plumbing, plastering and painting. Electrical wiring has not been treated in this unit due to the time needed for complete coverage of electrical theory and amount of work. However, it is suggested that the class involved in the unit on residential and industrial wiring in the 11th grade could use the building for its work in wiring.

Suggested types of buildings are:

1. Storage building for lawn and garden tools.
2. Child's play house (scaled from full size).
3. Camp - "A" frame or conventional construction.

Suggested Texts:

Hornung, William J. Architectural Drafting. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1960.

Ray, J. Edgar. Graphic Architectural Drafting. Bloomington, Ill.: McKnight and McKnight Publishing Company, 1960.

U. S. Department of Agriculture. Wood-Frame House Construction. Washington, D.C.: U. S. Government Printing Office, 1955.

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Close, Paul Dunham, Building Insulation. Chicago, Ill.: American Technical Society, 1952.

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Dalzell, Ralph J. and Townsend, Gilbert. Concrete Block Construction for Home and Farm. Chicago, Ill.: American Technical Society, 1951.

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Framing, Sheathing and Insulation. New York: Delmar Publishers, Inc.

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Giese, Henry. A Practical Course in Concrete. Chicago, Ill.: Portland Cement Association, 1948.

Guide to Audio-Visual Aids. Champaign, Illinois: University of Illinois, Division of University Extension, 1954-55.

Hammond, James J. and Others. Woodworking Technology. Bloomington: McKnight and McKnight Publishing Company, 1961.

Hodgson, Fred T. Cyclopedia of Bricklaying, Stonemasonry, Concretes, Stuccos, Plaster and Everything Concerned with These Allied Trades. Chicago, Ill.: Frederick J. Drake & Co., 1916.

Hoppock, Robert. Occupational Information. New York: McGraw-Hill Book Company, Inc., 1957.

Hornung, William J. Architectural Drafting. Englewood: Prentice-Hall, Inc., 1960.

Hornung, William J. Blueprint Reading: Interpretation of Architectural Working Drawings. Englewood: Prentice-Hall, Inc., 1961.

Industrial Aids in Industrial Education. Walter Burdette, Editor. Division of Industrial Education, Arizona State University.

Interior and Exterior Trim. New York: Delmar Publishers, Inc.,

Jarvis, William D., Editor. Painting and Decorating Encyclopedia. Chicago: Goodheart-Willcox Co., Inc., 1957.

Lair, E. A. Carpentry for the Building Trades. New York: McGraw-Hill Book Company, Inc., 1953.

Matthias, Jr., A. J. and Smith, Sr., Estes. How to Design and Install Plumbing. Chicago, Ill.: American Technical Society, 1960.

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Occupational Outlook Handbook, Bulletin 1300. Washington: Government Printing Office, Superintendent of Documents, 1961.

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Spencer, Henry C. Basic Technical Drawing. New York: The MacMillan Co., 1956.

Townsend, Gilbert. Steel Square. Chicago: American Technical Society, 1947.

Townsend, Gilbert and Dalsell, Ralph J. How to Plan a House. Chicago: American Technical Society, 1958.

Wilson, J. Douglas and Werner, S. O. Simplified Stair Layout. New York: Delmar Publishers, Inc., 1947.

Tools and Equipment: (Suggested partial list)

I. Carpentry Tools and Equipment:

A. Layout Tools:

1. Chalk line
2. Combination compass-dividers
3. Level aluminum 2'
4. Plumb bob
5. Rules: 6 foot folding
6. Squares; combination, framing and sliding T-bevel
7. Tapes; 6 foot and 50 foot steel
8. Transit

B. Cutting tools:

1. Bits; auger (¼" to 1"), expansive
2. Bit brace
3. Carbon drills (set)
4. Chisels; wood (set of four), cold
5. Countersink
6. Files; flat, rat tail
7. File card
8. Knives; putty, sloyd, sheetrock
9. Planes; jack and block
10. Rasp; wood
11. Saws; back, crosscut, keyhole and rip
12. Snips; straight

C. Miscellaneous Tools:

1. Bars; wrecking and cats paw
2. Clamps; C and Quick
3. Gun; staple
4. Goggles; safety
5. Hammers; claw
6. Nail Sets; (1/16" & 1/8")
7. Pliers; side cutting, water pump
8. Screwdrivers; regular, philips head
9. Wrenches; adjustable

Tools and Equipment: (Continued)

II. Plumbing Tools and Equipment:

1. Blow torch
2. Caulking iron set
3. Die set (½" to 2")
4. Flaring tool
5. Hack saw
6. Joint runner
7. Melting pot
8. Pipe wrench
9. Pipe vise
10. Pouring ladle
11. Propane torch
12. Spark lighter
13. Tubing cutter

III. Masonry and Concrete Tools and Equipment:

1. Measuring box (bottomless)
2. Steel trowel
3. Masonry trowel
4. Pointing trowel
5. Mason's level
6. Brick hammer
7. Brick set
8. Mortarboard
9. Jointing tools

IV. Plastering tools

1. Level and straight edge
2. Float
3. Hawk
4. Pointing trowel
5. Rectangular trowel
6. Tin snips

Special Tools and Equipment: (Suggested partial list)

A. Brad pusher
B. Small wrenches
C. Transit and accessories
D. Microscope
E. Bunsen burner
F. House jack (small)
G. Mail scale
H. Bath scale
I. Balance scale
J. Hose (plastic and rubber)
K. Water pail

Materials and Supplies: (Suggested partial list)

I. Carpentry:

1. Building materials:

    (a) Hardware, nails, etc.
    (b) Framing lumber, 2 x 4's, etc.
    (c) Finish lumber
    (d) Plywood
    (e) Sheetrock
    (f) Clapboards
    (g) Asphalt shingles
    (h) Flashing
    (i) Molding
    (j) Flooring
    (k) Insulation
    (l) Building felt

II. Concrete and Masonry:

1. Bricks
2. Cement
3. Sand
4. Mortar

III. Plumbing:

1. Iron pipe
2. Fittings
3. Tubing
4. Valves
5. Solder
6. Flux

IV. Plastering:

1. Lath
    (a) Wood
    (b) Metal
    (c) Wire
    (d) Gypsum
    (e) Insulating

2. Plaster

3. Lath nails

Lessons to be Taught:

Manipulative lessons

This list of lessons was taken from the analysis of objectives and includes those lessons which enable the student to carry on the activities suggested by the unit.

Lessons to be Taught: (Continued)

Manipulative lessons (continued)

1. Sheet layouts and title blocks.
2. Architectural lettering.
3. Plan conventions.
4. Floor plans.
5. Elevations.
6. Details.
7. Using templates and drafting machines.
8. Locating, layout, and use batter boards.
9. How to build forms.
10. Framing walls, floor and openings.
11. Layout and cutting the common rafter.
12. Sheathing a building.
13. Constructing and setting door and window frames.
14. Applying roof covering materials.
15. Building cornices and gable trim.
16. Gutters and their installation.
17. Wall sidings and installing them.
18. Installing windows and doors.
19. Applying insulation and interior wall coverings.
20. Floorings and their application.
21. Interior trim and its installation.
22. Layout and install a straight stair run.
23. Cabinet and built-in construction methods.
24. Laying a brick wall.
25. Simple pipe and tubing fitting.
26. Plastering.
27. House painting.
28. Lessons on those hand and machine tools as needed to complete the activity.

    Layout and measuring tools
    Cutting and boring tools
    Supporting and boring tools
    Percussion and impelling tools
    Devices made on the job
    Portable power tools
    Machines

29. Use of plumbing tools and equipment.
30. Use of concrete and masonry tools and equipment.
31. Use of plastering tools and equipment.
32. Use of painting tools and equipment.

Related lessons

This list of lessons was taken from the analysis of objectives and is in the nature of general statements of information to be taught rather than in specific titles.

It should be noted that this list does not include films, discussions, and other teaching methods suggested to achieve the behavior changes.

__Lessons to be Taught__: (Continued)

__Related lessons__ (Continued)

1. The residential construction industry.
2. Architectural styles.
3. Woods used in construction.
4. Metals used in construction.
5. Roofing and siding materials.
6. Masonry materials used in residential construction.
7. Ceramic materials used in residential construction.
8. Overview-scope and considerations in architectural drafting.
9. Elements in the field of architecture.
10. Construction elements.
11. Estimating.
12. Blueprint reading.
13. Specifications.
14. Regional variations in house construction.
15. Trends in home construction.
16. Types of wall framing.
17. Principles of roof framing.
18. Electrical and plumbing considerations for the carpenter.
19. Introduction to brick masonry.
20. Home heating systems.
21. Heat loss.
22. Introduction to plumbing.

__Teaching Aids and Devices__: (Partial list)

I. Model house.
II. Models of the different types of construction.
III. House plans.
IV. Samples of building materials from local lumber companies.
V. Millwork chart.
VI. Nail chart.
VII. Pupils will view slides on steps of building a house.
VIII. Pupils will see films on the residential construction industry.

A. __Building a Home with Western Pines__. 1951. 25 minutes, sound, free loan. Show actual construction of Cape Cod house from laying of lines to completion.

Western Pine Assn.
510 Yeon Building
Portland 4, Oregon

B. __Building a House__. 1947. 10 minutes, sound, black and white, rent $2.50. Shows construction methods and practices from the start to finish of a house.

Encyclopedia Britannica Films, Inc.
161 Massachusetts Avenue
Boston 16, Massachusetts

Teaching Aids and Devices: (Continued)

C. The Carpenter, 1951. 52 minutes, sound, color, free loan. Shows various kinds of work performed by carpenters, sponsored by the Brotherhood of Carpenters and Joiners.

M. A. Hutcheson
222 E. Michigan St.
Indianapolis, Indiana

D. Down the Drain. 1954. 11 minutes, sound, color, free loan. Follows the plumber from start to finish as he installs a plumbing system in a house.

Chase Brass and Copper Co.
Executive Offices
Waterbury 20, Conn.

E. Gypsum Lathing and Plastering. 1948. 15 minutes, sound, black and white, free loan. Master craftsmen illustrate techniques used in the trade.

Gypsum Assn.
20 North Wacker Drive
Chicago 6, Illinois

F. Prefabrication with Plywood. 1942. 35 minutes, sound, color, free loan. Survey of prefabrication industry giving details on house and commercial structures.

Douglas Fir Plywood Assn.
Tacoma Building
Tacoma 2, Washington

G. Sheet Metal in Building Construction. 1953. 45 minutes, sound, black and white, free loan. Shows installations of sheet metal articles and work in progress on buildings of many types.

Revere Copper and Brass, Inc.
108 Arlington St.
Boston, Mass.

H. Your Future in Trees. 1948. 20 minutes, sound, color, free loan. Shows importance of trees to home surroundings, illustrates selection and training of men for profession.

Davey Tree Expert Co.
Kent, Ohio

Evaluation Techniques:

1. Observation.
2. Written reports.
3. Oral reports.
4. Discussion.
5. Quizzes .
6. Research reports.

Evaluation Techniques: (Continued)

7. Results of experiments.
8. Outlines of reading assignments.
9. Performance tests.
10. Notebook.
11. Projects and activities.
12. Pretest and retest.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavioral changes listed in the analysis of the objectives have been accomplished.

Title of Unit: Transportation Construction

Introduction:

The wide realm of the transportation of material, people and services and the attendant construction problems has been, and probably will always continue to be, one of man's greatest branches of activity. From primitive trails, through waterways, roads, steel rails, super-highways, air transport and rocketry, the race continues. Always the challenge has been to move more material easier and quicker. To aid in this never-ending effort, man has called upon his inventive and constructive abilities.

Nowadays, as never before, construction to facilitate transportation is really big business. In this field, workers in all degrees of skill, training and ability are in constant demand.

In the light of this unique situation and the tremendous number of job opportunities open to him, it might be well for the interested high school boy to give some serious consideration to this area of the construction industry.

Scope:

a. 10th grade

b. 3 - 6 weeks (suggested)

c. 200 - 275 minutes per week (min.)

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Objectives

1. To develop in each pupil an understanding of the transportation construction industry, its operations, and its value to the nation.
2. To develop in each pupil knowledges and skills in the use of some principles, processes, materials and equipment used in highway construction.
3. To encourage in each pupil an appreciation of good design and workmanship in highway construction and in structures related to this work.
4. To acquaint pupils with the occupational opportunities available in this industry.

Objective: 1. To develop in each pupil an understanding of the transportation construction industry, its operations, and its value to the nation.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know the story of early transportation.	a. Have pupil trace progress of roads from trails to highways.
	b. Study trade routes.
	c. Study types of ancient roads, Egyptian, Greek and Roman. Discuss improvements.
2. He will see how the economy of a country is controlled by transportation.	a. Show how waterways and shipping influenced the economy of countries.
	b. Follow exploration routes and explain results derived from them.
	c. Discuss the changes caused by the coming of the railroad in this country.
	d. Have pupil show sketches or pictures of early types of vehicles, trains, etc.
3. He will know the great socio-economic change caused by the new highway system.	a. Discuss the effect on roads and road building brought about by the invention of the automobile.
	b. Trace the change from urban to suburban living.
	c. Discuss how shopping centers have changed the habits of people.
	d. Show movies of these changing patterns.
	e. Have pupil scan TV showings and report to class items of interest regarding roads and highways in other locations.
4. He will know the effect of federal funds in the highway program.	a. Study maps showing the linking of great production areas to commercial markets.
	b. Show how industry can move its operations to a good labor area and still quickly deliver merchandise easily over good highways.

Objective: **1. (Continued)**

Expected pupil behavioral change	Suggested activities to implement the change
4. (Continued)	c. Study the interstate highway system in Maine. Devise new routes.
	d. Read notices of new contracts awarded and road work jobs completed.
	e. Make charts showing road work in progress.
	f. Investigate different methods used to finance a road job.
5. He will realize the tremendous effect on the financial condition of the heavy equipment industry brought about by the new road work.	a. Discuss types of equipment used in road construction.
	b. Read highway construction magazines and compare costs of equipment and jobs.
	c. Visit local road jobs and see equipment in action.
	d. Visit dealers' showrooms. Talk with the salesmen. Invite a speaker to the classroom.
6. He will understand about the different classes of highways, federal, state and local.	a. Invite a speaker from the city engineer's office to explain types.
	b. Visit different locations showing various types of highways.
	c. Examine highways being demolished to learn previous construction methods.

Objective: 2. To develop in each pupil knowledges and skills in the use of some principles, processes, materials and equipment used in highway construction.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know the steps involved in the building of a highway from the idea of the project to the finished job.	a. Discuss the planning procedure in the initial steps of the work.
	b. Discuss the legal aspects connected with lining out the road.
	c. Study the work of the surveyor in the field.
	d. Discuss the office work and the preparation of job specifications.
	e. Invite a surveyor in to talk about his work.
	f. Discuss bids, bonds and contracts.
	g. Have a road construction contractor give a talk.
	h. Show movies of road work.
	i. Have pupil make individual reports on various phases of the work, as rough grading, drainage, surfacing, access roads, safety features, signs and lights, bridges and overpasses, interchanges, etc.
2. He will recognize good design in highway construction.	a. Show aerial photos of modern highways.
	b. Study maps to determine if good principles have been followed.
	c. Take a trip over a section of road and discuss its features.
3. He will become familiar with road construction materials.	a. Visit a road job in progress.
	b. Visit a gravel pit and bring home samples for study.
	c. Visit a rock crushing plant, study operations and get samples.

Objective: 2. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
3. (Continued)	d. Study about cements and tars. If possible make visits. Get samples.
	e. Visit the Maine State Highway Laboratory and see materials and the testing programs being carried out.
4. He will know about the lesser known materials used in highway work.	a. Discuss other materials used in highway construction, reinforcing materials, oils, structural steel, other metals, etc.
	b. Look up specifications on these metals as to sizes and strengths.
	c. Make drawings of structural steel.
	d. Make drawings of reinforced concrete work.
5. He will know about the safety feature materials.	a. Discuss lights and lighting, signs and reflectors used along the highways.
	b. Study luminous paint and marking symbols.
	c. Discuss traffic signs and their importance to the orderly flow of traffic.
	d. Invite a traffic control officer in to give a talk.
	e. Show films of the movement of traffic.
	f. Discuss why interchanges and overpasses are major factors in highway construction
6. He will know why the problem of proper drainage is so important.	a. Discuss land surface as to content and shape--sandy, clay, gravel, ledge, etc., and if level, rolling or mountainous.
	b. Discuss contour lines and study topographical maps.

Objective: **2. (Continued)**

Expected pupil behavioral change	Suggested activities to implement the change
6. (Continued)	**c. Assign an area to be reproduced with contour lines (drafting).**
	d. Have profiles drawn for a proposed road from actual points on a map using the contour lines given.
7. He will know of the various types of equipment used in highway construction.	**a. Prepare a scrapbook showing pictures of roadbuilding equipment.**
	b. Learn the purpose of the various pieces of equipment.
	c. Have pupil talk with relatives or friends who work on road jobs and give reports on the different equipment.
	d. Show movies.
	e. Have pupil bring from home models of road building machinery. (Courtesy of younger members of the family).
	f. Set up a display of the equipment.

Objective: 3. To encourage in each pupil an appreciation of good design and workmanship in highway construction and in structures related to this work.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize good planning in the style and type of new highways.	a. Discuss modern heavy-duty, high-speed highways versus the first class roads of a few years ago. b. Make a traffic survey and compare the traffic moving on good roads and that moving on poor roads. c. Discuss the purposeful thinking and planning in the construction of modern roads as opposed to the wandering fashion of old-time highways. d. Encourage those pupils who have travelled to tell about roads that they have been over. e. Show how modern highways are planned for years of fast, safe traffic.
2. He will appreciate the scenic values of carefully constructed and located roads.	a. Make a scrapbook of pictures showing new roads and structures and tell about them in class. b. Discuss picnic, rest and service areas, so important along interstate roads. c. Discuss the value of scenic turnouts where practical. d. Discuss tree planting and landscaping. e. Discuss highway patrol work and the responsibility of travelers to cooperate in maintaining attractive highways.
3. He will appreciate the skilled workmanship that goes into the building of a modern highway and the attending structures.	a. Compare the bridge construction of olden times with the modern highway bridge.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
3. (Continued)	b. Suggest a competition for the best design of a modern overpass. c. Discuss methods used to insure years of rapid, safe transportation on our highways. d. Discuss safety features and obedience to them by the motorist. e. Have pupil notice how grades and curves are constructed for safe, rapid travel. f. Discuss the artistic as well as the functional design of bridges and other built-up features. g. Study the care in the placing of the road-surfacing materials. h. Discuss the building of retaining walls. i. Show movies of road features.

Objective: 4. To acquaint pupils with the occupational opportunities available in the highway construction industry.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will become motivated to learn about job possibilities in highway construction.	a. Have a speaker in from the Maine State Employment office.
	b. Advise a trip to the guidance office for help with occupational material.
	c. Have reports given from library material.
	d. Appoint a committee to get job opportunity materials for the bulletin board.
	e. Learn what are good qualifications to help a worker with his job.
2. He will recognize the position of union and non-union workers and their importance in this industrial field.	a. Have pupil make a brief study of unions in this type of industry.
	b. Invite local union president in to give a talk about unions.
	c. Assign a committee to report on the number of unions involved in transportation construction, and describe some of their rules, etc.
3. He will realize that he himself will soon be looking for a job.	a. Study good and poor features of the transportation construction industry.
	b. Compare interests in this industry with similar interests in other industries.
	c. Investigate the probable chances of success.
	d. Make a study of background fundamentals which will insure advancement.
	e. Reject those areas where he knows that he will not be interested.

Approach:

The following listed items may be used to gain attention and stimulate interest in the pursuit of this unit.

1. Show a selected film on highway construction in progress.

2. Bring in to class some models of construction equipment.

3. Invite a member from the guidance department to give a talk about occupations.

4. Have pupils answer a questionnaire over occupations.

5. Give a talk, pointing out that the construction industry is still a growing business, with new materials and methods producing better results and creating a greater demand than ever before for skilled workers.

Activities, Projects and Experiences:

1. Get samples of highway materials. (group assignments)

    a. soils
    b. sand
    c. gravel
    d. aggregate
    e. cement
    f. bituminous materials

2. Get road information materials. (individual assignments)

    a. highway maps
    b. road folders
    c. topographic maps

3. Make listings of pertinent information. (committee assignments)

    a. road projects presently underway in Maine
    b. classes of different highway systems in the United States
    c. types of different road surfaces
    d. types of road building machines and equipment
    e. kinds of jobs
    f. job requirements, age, experience, physical condition, etc.
    g. union versus non-union conditions
    h. work conditions, absenteeism, seasonal, wages, weather, etc.

4. Make drawings. (entire class)

    a. road layout from points (termini) given on map
    b. profile of surface over this line
    c. grade line profile over this line
    d. problems involving contour lines
    e. road cross sections
    f. design an overpass structure
    g. structural steel members
    h. reinforced concrete beams
    i. an interchange pattern

Activities, Projects and Experiences: (continued)

5. Operations. (group assignments)

   a. screen bank gravel for sizing
   b. weigh parts and figure percentages
   c. make form for model box culvert
   d. install wire reinforcement
   e. mix and run concrete in form
   f. take down form
   g. make model of rock crushing plant, show screening in operation
   h. build model overpass
   i. build road cross sections for different types of roads
   j. make a model of a portion of the earth's surface and show elevations by contour lines

6. Inspection trips. (class, groups or individuals)

   a. road jobs
   b. testing laboratory
   c. road equipment dealers

Resource Material:

Agg, T. R. Construction of Roads and Pavements, Fifth Edition. Iowa State College: New York: McGraw-Hill Book Company, Inc., 1940.

American Association of State Highway Officials. A Policy on Geometric Design of Rural Highways, Second Printing. Washington: 917 National Press Building, 1955.

Bruce, Arthur G. and Clarkson, John, Highway Design and Construction, Third Edition. Scranton, Penn: International Textbook Company, 1950.

Davis and Foote. Surveying, Fourth Edition. University of California, New York: McGraw-Hill Book Company, Inc., 1953.

Dictionary of Occupational Titles, Second Edition. Washington: U. S. Department of Labor, Government Printing Office, 1949.

Educators Guide to Free Films, 22nd Ed. Randolph, Wisconsin: Educators Progress Service, 1962.

Engineering News Weekly. Weekly Magazine. New York: McGraw-Hill Book Company, Inc.

French, Thomas E. and Svensen, Carl L. Mechanical Drawing, Sixth Ed. New York: McGraw-Hill Book Company, Inc., 1957.

Healey, Kent T. The Economics of Transportation in America. New York: The Ronald Press Co., 1943.

Hennes and Ekse. Fundamentals of Traffic Engineering. New York: McGraw-Hill Book Company, Inc., 1955.

Resource Material: (Continued)

Hoppock, Robert. Occupational Information. New York: McGraw-Hill Book Company, Inc., 1957.

Improving Industrial Arts Teaching, Conference Report. Washington: U. S. Department of Health, Education, and Welfare, Office of Education, 1960.

Interpreting Industry Through Line Production. Maine: State Department of Education. Division of Vocational Education, 1962.

Matson, Hurd, and Smith. Traffic Engineering. New York: McGraw-Hill Book Company, Inc., 1955.

Meyer, Carl F. Route Surveying. Scranton, Pennsylvania: International Textbook Company, 1949.

Occupational Outlook Handbook, Bulletin 1300. Washington: Government Printing Office, Superintendent of Documents, 1961.

Spencer, Henry C. Basic Technical Drawing. New York: The MacMillan Co., 1956.

The Asphalt Handbook, Manual Series No. 4 (MS-4). College Park, Maryland: The Asphalt Institute, 1962.

Urquhart, Leonard. Civil Engineering Handbook, Fourth Edition. New York: McGraw-Hill Book Company, Inc., 1959.

Woods, K. B. Highway Engineering Handbook. New York: McGraw-Hill Book Co., Inc., 1960.

Subject Matter in Highway Engineering

A typical outline of the course of study as required for a degree in highway engineering.

1. Construction
    a. construction planning
    b. construction materials
    c. records and estimating
    d. bituminous and concrete materials
2. Design
    a. elements of highway design
    b. highway design
    c. hydraulics and drainage
3. Engineering law
4. Strength of materials
5. Structural design
6. Reinforced concrete design

Resource Material: (Continued)

Subject Matter in Highway Engineering (Continued)

7. Soils engineering
8. Surveying
9. Drafting
    - a. lettering, instruments, geometrical constructions, projections, dimensions, symbols, scales, shop practices.
    - b. sections, auxiliary views, assembly drawings, inking, tracing, prints, pictorial drawing, sketching.
    - c. highway plans, cross sections, profiles, topography, grades and curves, topographic symbols, map making, scales, sketching, contour lines, copying, duplication, reproduction.
    - d. photogrammetry, fundamentals, aerial photos, geometry of aerial photos, photo interpretation, use of stereoscopic instruments, preparing maps from photos.

Text Material

The following is a listing of main areas covered in a typical text on highway design and construction. [1]

Highway administration
Highway location
Design of roads
Design of intersections
Grading, subgrades, and base courses
Highway drainage
Low cost roads
Types of road surfaces (pavements)
General highway maintenance
Estimates, contracts, and specifications
Control and testing of construction materials
Transportation surveys

Planning a New Highway

A typical sequence of field and office work. [2]

For planning:

1. Idea of project
2. Field reconnaissance (of a proposed area)
3. Preliminary surveys, study of topography
4. Office studies
5. Location surveys, aerial surveys

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[1] Bruce, Arthur G. and Clarkson, John. Highway Design and Construction, Third Edition, Scranton, Penn.: International Textbook Co., 1950.

[2] Meyer, Carl F. Route Surveying. Scranton, Penn.: International Text. Co., 1949.

Resource Material: (Continued)

Occupations

Titles of some occupations of construction workers.[3]

- Aggregate plant operator
- Asphalt worker
- Automobile maintenance
- Automobile mechanic & helper
- Back hoe operator & helper
- Batch plant worker
- Blade grader operator
- Blaster
- Block paver
- Bookkeeper
- Brick worker & helper
- Bulldozer operator
- Carpenter & helper
- Cement conveyor operator
- Cement finisher & helper
- Cement handler
- Compressor engineer
- Mason & helper
- Masonry inspector
- Mechanic
- Oiler
- Paving breaker operator
- Pile driver operator
- Power shovel operator
- Reinforcement worker
- Reinforced concrete worker
- Reinforced concrete inspector
- Sand and gravel worker
- Concrete batching & mixing plant workers
- Crane operator
- Crushed stone grader
- Crusher operator
- Driller
- Ditcher operator
- Draftsman
- Electrician
- Elevator operator
- Engineer & helpers
- Form setters
- Grader operator
- Highway foreman
- Highway inspector
- Jack-hammer man
- Laborer
- Scale weigher
- Scarifier operator
- Scoop loader operator
- Scraper operator
- Stone worker
- Superintendent of construct
- Surveyors & helpers
- Time keepers
- Truck operators
- Welder

Tools and Equipment:

1. For asphalt work:
   - cans
   - containers
   - pail for fuel oil
   - rake
   - shovel
   - tamper
2. For concrete work:
   - bath scale
   - boxes
   - cans
   - mixing pan
   - shovel
   - straight-edge
   - trowel
   - water pail

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[3] Dictionary of Occupational Titles, Second Edition. Washington, D. C.: U. S. Department of Labor, Government Printing Office, 1949.

Tools and Equipment: (Continued)

3. For drafting:

   instruments
   & equipment

4. For gravel work:

   boxes
   cans
   mail scale
   sacks
   screening
   3/4" sieve
   #4 sieve
   #10 sieve
   #40 sieve
   shovel

5. For woodwork:

   bit brace
   bit set
   block plane
   combination square
   hack saw
   hammer
   hand drill, 1/4" & drills
   Jack plane
   Jack knife
   miter box & saw
   nail set, med.
   nippers
   pliers, side cut
   rule or tape
   saw, coping
   saw, cross cut
   saw, rip
   screw drivers
   snips
   vise, wood
   vise, metal
   wood chisels, ¼", ½", 3/4"

6. Miscellaneous equipment:

   movie projector
   paint brushes
   screen
   transit & accessories

Material and Supplies:

1. For asphalt work:

   asphalts
   bituminous material
   tars
   fuel oil

2. For concrete work:

   aggregates
   cement
   form oil
   iron rods, 1/8, 1/4"
   reinforcement rods, 1/4"
   sand
   screening, 1/4" (for reinf.)
   wire, various sizes

Materials and Supplies: (Continued)

3. For drafting:

paper, drafting
paper, cross section
paper, tracing
paper, blue or whiteprint
tape

4. For gravel work:

crushed rock
gravel
sand
metal scraps
rods, var. sizes, 1/8, 1/4"
#20, galv. iron or aluminum
wire mesh
  window screen
  6 per inch
  4 per inch
  half inch

5. For woodwork, model building:

brads
burlap
chicken wire
dowels, 1/8, 1/4, 3/8"
nails
pine shorts
plaster of paris
plywood, 1/4, 1/2"
screws
strips of inner tube
thread spools

Lessons to be Taught:

Objective 1.

1. History and development of roads.
2. Story of trade routes.
3. Importance of waterways.
4. Economic changes caused by the railroad.
5. The automobile and road building.
6. Population spread to the suburbs.
7. More private ownership of property.
8. Living needs requires travel.
9. Agricultural and manufactured goods to markets.
10. Production moves to the labor market.
11. The interstate in Maine.
12. Progress in interstate work.
13. Maine work now in progress.
14. How road jobs are financed.
15. Types of road equipment in use.
16. Comparison of costs, jobs and equipment.
17. How equipment operates on the job.
18. New equipment and improvements.
19. The classes of highways.
20. Appearance of various types.
21. Study previous construction methods.

Lessons to be Taught: (Continued)

Objective 2.

1. How roads are planned.
2. The legal aspects involved.
3. What the survey does.
4. Office work and specifications.
5. A contractor's responsibility.
6. How work is carried on.
7. Operation steps, grading, drainage, access roads, safety features, signs, lighting, bridges, interchanges.
8. Use of aerial surveys.
9. How roads are lined out.
10. Visit a job in progress.
11. Visit a gravel pit, get samples.
12. Visit a crushing plant, get samples.
13. What cement is.
14. What asphalt is.
15. Laboratory tests on materials.
16. Other materials in highway work.
17. Study of metal specifications.
18. Study of structural drafting.
19. Reinforced concrete drafting.
20. Importance of good lighting.
21. The purpose of highway paint.
22. The use of traffic signs.
23. Values of interchanges.
24. Land surface and its composition.
25. How topographic maps work.
26. What contour lines are.
27. How to draw a profile.
28. Types of construction equipment.
29. Work done by various types.
30. Study of models and types.
31. Display of equipment.

Objective 3.

1. Improvements in road building.
2. Movement of traffic.
3. Planning requirements for a proposed road.
4. Comparison of U. S. and foreign roads.
5. Life span of highways.
6. Location of turn-outs.
7. Why landscaping is done.
8. Need for a highway patrol.
9. Skill in bridge building.
10. Safety features in highway building.
11. The motorist's responsibility for safety.
12. Safety design for curves.
13. Artistic design of structures.
14. Care in road surfacing.
15. Use of retaining walls and embankments.

Lessons to be Taught: (Continued)

Objective 4.

1. What are job possibilities in highway construction.
2. How the guidance dept. helps.
3. Use of the library.
4. Bulletin board publicity.
5. Job qualifications.
6. Unions in highway const.
7. Union effects on employer.
8. Union effects on employee.
9. Good and poor features of the industry.

Objective 5.

1. Job possibilities available.
2. Information from experts.
3. Self-examination of the work.
4. The value of the instructor-pupil conference.
5. Assistance of guidance facilities.
6. Education aids success.
7. Better jobs to better qualified workers.
8. Mechanization and skilled workers.
9. Pupils own comparison of work and education.

Teaching Aids and Devices: (Suggested Ideas)

1. Visit to a gravel pit and getting samples.
2. Visit to a crushing plant and getting samples.
3. Visit to a tar plant and getting samples.
4. Visit to the Maine State Highway testing laboratory.
5. Visit to a road equipment dealer, inspecting machinery, and getting literature.
6. Visit to a road job for first-hand observation.
7. Use of highway maps.
8. Use of state publicity maps.
9. Use of topographical maps.
10. Models of road construction machinery.
11. Models of earth's surface. (plaster)
12. Model of a screening plant.
13. Model of a box culvert. (concrete)
14. Films of highway construction and related material.
15. Study of reference and text books and magazines.

Teaching Aids and Devices: (Continued)

A Bibliography of Related Films

1. American Road, The. (no date), 16 mm, 38 minutes, sound, color, free loan. Shows road changes in America over a span of 50 years and how man's methods of transportation has influenced his life, his business, his health and his recreation.

   Ford Motor Company
   16 East 52nd Street
   New York 22, N. Y.

2. Asphalt Through the Ages. (no date), 16 mm, 13½ minutes, sound, color, free loan. Shows the use of asphalt from ancient times to the present day, both by animation and actual photography.

   The Asphalt Institute
   Visual Aids Department
   Asphalt Institute Building
   College Park, Maryland

3. Building a Highway. (no date), 16 mm, 17 minutes, sound, color, free loan. Shows the history of the road from the Appian Way to our present superhighways. (Portland Cement Association).

   Modern Talking Picture Service
   235 Stuart Street
   Boston 16, Mass.

4. Champions of the Highway. 1962. 16 mm, 26 minutes, sound, color, free loan. Tells how trucking helps the nation's economy and defense. The second half shows safety and driver skills.

   American Trucking Association, Inc.
   1616 P Street, Northwest
   Washington 6, D. C.

5. Construction Ahead. 1948. 21 minutes, 16 mm, sound, color, free loan. Shows construction program in progress.

   Pennsylvania Department of Highways
   Bureau of Publicity and Information
   North Office Building
   Harrisburg, Pennsylvania

6. From Byway to Superhighway. (no date), 16 mm, 16½ minutes, sound, color, free loan. Shows the steps leading to the development of heavy-duty asphalt highways.

   The Asphalt Institute
   Visual Aids Department
   Asphalt Institute Building
   College Park, Maryland

A Bibliography of Related Films (Continued)

7. Highway Lifelines. 1956. 16 mm, 16 minutes, sound, color, free loan. Tells the story of highway paint.

    Hercules Powder Company
    Advertising Department
    Wilmington, 99 Delaware

8. Jonah and the Highway. 1958. 16 mm, 25 minutes, sound, black and white, free loan. Shows problems in building a highway and also serves as a stimulus to help young men in entering the highway engineering profession.

    United States Steel Corporation
    71 Broadway
    New York 6, N. Y.

9. Men Working. 1951. 16 mm, 15 minutes, sound, color, free loan. Tells of highway maintenance with operations to help keep roads in good condition.

    Pennsylvania Department of Highways
    Bureau of Publicity and Information
    North Office Building
    Harrisburg, Pennsylvania

10. New Jersey Turnpike, The. 1957. 16 mm, 24½ minutes, sound, color, free loan. Shows the construction of the New Jersey Turnpike.

    The Asphalt Institute
    Visual Aids Department
    Asphalt Institute Building
    College Park, Maryland

11. On the Move. 1957. 16 mm, 25 minutes, sound, color, free loan. Deals with the importance of transportation. Actual construction work shown, including much of the St. Lawrence Seaway Project. Shows how modern machinery makes this heavy work of transportation possible.

    Austin Productions, Inc.
    Distribution Department
    Box 713
    Lima, Ohio

Evaluation Techniques:

1. Care in making tests and working with samples.
2. Completion and quality of scrap book.
3. Cooperation with fellow class members.
4. Degree of understanding of work on unit.
5. Quality of work on drawings.
6. Quality of models built.
7. Sincerity in making oral reports.
8. Thoroughness of investigation and study on written reports.
9. Willingness in project participation.
10. Yielding results beneficial to the pupil.
11. Testing results.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavior changes listed in the analysis of the objectives have been accomplished.

Electrical-Electronics and Power and Transportation Industries

Grade 11

Industrial Arts 211

Title of Unit: Thermal Power
Topic I - Portable Power Plant Industries

Introduction:

Thermal power and its use by the portable power plant industries is of growing importance in our society today. The industrial and home uses of portable power plants have not only stimulated manufacturing but servicing in this field.

Since a study of power mechanics becomes very technical and most complex in many of its uses, the portable power plant offers a practical means through which to acquaint the beginning pupil with the harnessing of thermal power and the nature of the huge industry of which the power plant is a product.

Scope:

a. 11th grade

b. 6 - 9 weeks (suggested)

c. 280 minutes per week (min.)

Objectives

1. To develop in each pupil a basic understanding and appreciation of the thermal power industry-especially the portable power plants: types, overview of principles, components, fuels, standards and applications.

2. To develop in each pupil a general understanding of the occupational scope, organizational patterns, and opportunities in the thermal power industry and particularly in the portable power plant industry.

3. To develop in each pupil a comprehensive, technical understanding of two and four cycle small gasoline engines-operational principles, repair, maintenance, safe use of tools and equipment-through problem-solving situations.

4. To develop in each pupil an understanding of consumer values and the ability to apply this knowledge in the wise selection of a portable power plant.

Objective: 1. To develop in each pupil a basic understanding and appreciation of the thermal power industry-especially the portable power plants: types, overview of principles, components, fuels, standards and applications.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a basic knowledge of the history of thermal power.	a. Reading assignment. b. Lesson - History of Power.
2. He will have a basic technical understanding of internal combustion type power plants.	a. Student written reports on: 1. Gasoline engines 2. Diesel engine 3. Steam turbine 4. Gas turbine 5. Rocket engine 6. Jet engine 7. Ram jet b. Lessons or instruction over: 1. Types 2. Principles 3. Fuels c. Reading assignment.
3. He will have a basic technical understanding of external combustion type power plants.	a. Lessons or instruction over: 1. Types 2. Principles 3. Fuels b. Reading assignment.
4. He will be aware of the many applications of internal and external combustion type portable power plants.	a. Lesson - Applications. b. Assignment.
5. He will have a basic technical understanding of other current and future sources of thermal power.	a. Lessons or instruction over: 1. Wind 2. Water 3. Sun 4. Atom 5. Others b. Reading assignment.

Objective: 1. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. He will be aware of the influence and effects and scope of the portable power plant.	a. Lesson - The Influence of the portable power plant.
7. He will have an understanding of the petroleum and natural gas industry.	a. Lesson - Discussion. b. Reading assignment.
8. He will be aware of the scope and plan of the local power and small engines industries.	a. Research report.

Objective: 2. To develop in each pupil a general understanding of the occupational scope, organisational patterns, and opportunities in the thermal power industry and particularly in the portable power plant industry.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a general knowledge of occupational scope of the thermal power industries - internal and external combustion.	a. Lesson - Opportunities in thermal power industries. b. Occupational assignment. c. Reading assignment.
2. He will be aware of the function and importance of management, research and development and servicing in the thermal power industries and particularly the portable power plant industry.	a. Discussion - lesson - Organisational structure of portable power plant industries.
3. He will have a general awareness of opportunities in portable power plant servicing.	a. Lesson - Servicing opportunities. b. Information sheet. c. Film - "The Motor Mechanic" Modern Talking Picture Service
4. He will be aware of emphasis on personal qualifications.	a. Lesson - Meeting qualifications and requirements.

Objective: 3. To develop in each pupil a comprehensive, technical understanding of two and four-cycle small gasoline engines - operational principles, repair, maintenance, safe use of tools and equipment-through problem-solving situations.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will apply the general theories of operation of small power plants.	a. Compression:
	1. 4-stroke cycle Reading assignment Lesson-4-cycle compression Job sheet
	2. 2-stroke cycle Instruction sheet Lesson-2-cycle compression Job sheet
	3. Valves Reading assignment Instruction sheet, 2-cycle Lesson - valves Job sheet
	b. Carburetion:
	1. 4-stroke cycle Reading assignment Gravity feed Lessons-Gravity; Suction Feed Systems Job sheet
	2. 2-stroke cycle Instruction sheet Lesson - carburetion Job sheet
	3. Fuel systems Reading assignment Job sheet
	c. Ignition:
	1. 4-stroke cycle Reading assignment Lesson - Ignition Job sheet

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
1. (Continued)	c. Ignition: (Continued) 2. 2-stroke cycle Instruction sheet Lesson - Ignition Job sheet 3. Piston Engine Electrical Systems Reading assignment
2. He will realize that basic principles of the small engine apply to larger engines as well.	a. Observe charts comparing small engines with automobile engines.
3. He will have an appreciation and respect for the mechanic's basic tools and equipment and their use and care.	a. Names, uses, care and proper manipulation will be given at the time the tool or piece of equipment is actually used in demonstration.
	b. Keep a tool and equipment list including - 1. Correct name of tool 2. Sketch of tool 3. Uses 4. Proper care and use 5. Safety
4. He will have an understanding of important terms relative to small gas engines and power.	a. Keep a terminology sheet.
5. He will have a fundamental knowledge of engine cooling systems.	a. Reading assignment.
6. He will know how and why engines are lubricated.	a. Reading assignment.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
7. He will be able to start, stop and store with respect to proper procedures and safety.	(4-cycle) a. Slide - b. Instruction sheet. c. Carry out steps in Start-Stop-Store. (2-Cycle) - Same as above
8. He will be able to carry out a complete engine checkup with respect to proper procedures and safety.	(4-cycle) a. Slide b. Instruction sheet. c. Do an engine checkup. (2-cycle) - Same as above
9. He will be able to apply knowledge to simple, safe, trouble shooting procedures.	(4-cycle) a. Lesson - simple trouble shooting procedures. b. Instruction sheet. c. Do simple trouble shooting. (2-cycle) - Same as above d. Reading assignment.

Objective: 4. To develop in each pupil an understanding of consumer values and the ability to apply this knowledge in the wise selection of a portable power plant.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will be aware of the variety of small engines on the market today and their many applications.	a. Bulletin board display. b. Discussion.
2. He will know how to select engines wisely.	a. Lesson and check sheet- Engine selection.
3. He will understand why it is important to keep engines in good repair.	a. Discussion.

Approach:

1. Bulletin board, display and lesson - scope of small engines industry.
2. Have a variety of portable power plant products on display and discuss each.

Activities:

The principal activity through which the objectives of this unit will be achieved will consist of study and work with two and four cycle small gasoline engines.

Suggested:

1. Disassemble a 2-stroke, 2-cycle engine and a four-stroke cycle engine
    a. make necessary checks, repairs and reassemble engine.
    b. start and run engine
2. Disassemble, test and assemble flywheel type magneto.
3. Clean and/or overhaul carburetor.
4. Troubleshoot "bugged" 2 and 4 cycle engines.

Suggested Texts:

Atteberry, Pat H. "Power Mechanics" Chicago, Ill.: TheGoodheart Willcox Co., Inc., 1961.

Briggs and Stratton Corp. "General Theories of Operation"Milwaukee, Wis.

Briggs and Stratton Corp. "Repair Instructions"

General Motors. "The Story of Power" Detroit, Mich.

Gerbracht, Carl and Robinson, Frank. "Understanding America's Industries" Bloomington, Ill.: MacKnight and MacKnight, 1962.

Stephenson, George E. "Power Mechanics". Albany, New York: Delmar Publishers, Inc., 1963.

Resource Materials:

Briggs and Stratton. Briggs and Stratton Manual. Milwaukee: Briggs and Stratton Corp.

Briggs and Stratton. General Theories of Operation. Milwaukee: Briggs and Stratton Corp.

Clinton. Clinton Manual. Maquoketa, Iowa. Clinton Machine Company.

Resource Material: (Continued)

Hercules-Lycoming. Hercules-Lycoming Manual. Canton, Ohio: Hercules Motors Corp.

Homelite. Homelite Manual. Port Chester, New York: Homelite Div. Textron, Inc.

Jacobsen. Jacobsen Manual. Racine, Wisconsin: Jacobsen Manufacturing Co.

Kohler. Kohler Manual. Kohler Company: Kohler, Wisconsin.

Lauson. Lauson Manual. New Holstein, Wisconsin: The Lauson Co., Div. of Tecumseh Products Co.

Lawn Boy. Lawn Boy Manual. Lamar, Missouri: Lawn Boy, Div. of Outboard Marine Corp.

McCulloch. McCulloch Manual. Los Angeles: McCulloch Corp.

Olson, Delmar W. Technology and Industrial Arts. Columbus, Ohio: Epsilon Pi Tau, Inc., 1957.

Purvis, Jud. All About Small Gasoline Engines. Chicago, Ill.: Goodheart-Willcox Co., Inc.

Small Engines Service Manual: Implement and Tractor Publications, Inc., 1014 Wyandotte, Kansas City, Missouri.

Tools and Equipment: (Suggested partial list)

Ring expander; Feeler gauge; Ring compressor; Torque wrench; Box end wrench; Needle-nose pliers; Screw drivers; Ratchet wrenches; Plastic mallet; Open-end wrenches; Inside and outside micrometer; Spark plug tester; Allen tester; Ridge reamer; Ring groover; "C" clamps; Punches; Allen wrenches; Gapping tool; Valve lapper; Wire brush; "Easy-outs"; Parts pan; Hammer.

Materials and Supplies: (Suggested partial list)

Solvent; gas-oil; Grease; Steel wool; Valve grinding compound; Friction tape; Point file; Solder; Liquid wrench; Gasket material; Gasket shellac; Emery Cloth; Plastic electrical tape; Paint; Shim stock.

Lessons to be Taught:

Manipulative lessons

This list of lessons was taken from the analysis of objectives and are listed in the nature of general statements of work to be taught rather than in specific titles.

1. Compression.
2. Carburetion.
3. Ignition.
4. Starting-stopping and storing an engine.
5. Engine check-up.
6. Trouble shooting.

Related Lessons

This list was taken from the analysis of objectives and is in the nature of general statements of information to be taught rather than in specific titles.

It should be noted that this list does not include films, discussions, and other teaching methods suggested to achieve the behavior changes.

1. History of power.
2. Internal combustion portable power plants.
3. External combustion portable power plants.
4. Applications of portable power plants.
5. Current and future sources of power.
6. Influence of the portable power plant.
7. Petroleum and natural gas industry.
8. Opportunities in thermal power industries.
9. Organizational structure of portable power plant industries.
10. Servicing opportunities.
11. Meeting qualifications and requirements.
12. Engine selection.

Teaching Aids and Devices:

1. Cut-away view of small engine.
2. Posters comparing small engines with automobile engines.
3. Flannel board.
4. Chalk and blackboard.
5. Charts on testing coil and condenser.
6. Flash cards on mechanics' tools.
7. Flannel board cards on different types of gauges used.
8. Enlarged model of cylinder and piston.
9. Poster on how to check point openings.
10. Flannel board cards showing opportunities in small engines' field.
11. Charts showing various parts of the electrical circuit.
12. Posters showing components of combustions.
13. Pounce patterns of mechanics' tools.
14. Flip charts on carburetor adjustments.
15. Cut-away view of the carburetor.
16. Stencils on how to troubleshoot small engines.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavioral changes listed in the analysis of the objectives have been accomplished.

Title of Unit: Thermal Power
Topic II - Transportation by Automobile

Introduction:

Man's progress in technology and civilization has followed a path that is parallel to man's development of power. For many years man has harnessed the natural energy of the earth. He has used the wind to drive his ships and grind his grain, and the energy of falling water to run his mills.

In more recent years the development of the heat engine and its application to industry and commerce have created a materialistic utopia. We manufacture more goods, grow more food, and have more leisure time than any other people on this earth. The heat engine is the most versatile and common device for converting the energy stored in fuels to useful work. Heat engines range from thousands of horsepower steam turbines to fractional horsepower glow plug engines. This unit will give the pupil an understanding of thermal power as it applies to the automobile engines and outboard engines.

Scope:

a. 11th grade

b. 6 - 8 weeks (suggested)

c. 280 minutes per week (min.)

Objectives

1. To develop in each pupil an insight into and understanding of the automobile industry and its place in our society.

2. To acquaint pupils with the occupational opportunities available in the automobile industry.

3. To develop in each pupil an understanding of the basic principles of thermal power and its application to products used in our society.

4. To develop in each pupil a degree of skill in applying basic principles of thermal power.

Objective: 1. To develop in each pupil an insight into and understanding of the automobile industry and its place in our society.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know the scope, size, variety and place of the automobile industry in the United States.	a. Lesson - "The Automobile Industry". b. Bulletin board display - "The Automobile Industry". c. Notebook for the unit.
2. He will know the importance of the automobile industry to people and industries of these United States.	a. Have the pupil bring in news items about the automobile industry and its effect on the welfare of the country. b. Have the pupil trace the development of the automobile from prehistoric times to the present. Discuss the effects of these developments on our society.
3. He will become familiar with those industries allied with the automobile industry.	a. Have the pupil list the different types of allied industries engaged or aiding in automobile manufacturing. b. Discuss vertical and horizontal integration within the automobile industry.
4. He will have a knowledge of how to select, finance and insure an automobile wisely.	a. Lesson - "Evaluating a car". b. Lesson - "Principles of design as they relate to the automobile". c. Show motion picture on the selection of an automobile. d. Lesson - "Financing an automobile". e. Have the pupil list the procedures a person must go through when financing an automobile. f. Lesson - "Automobile insurance and its importance". g. Lesson - "Laws regarding automobile insurance".

Objective: 2. To acquaint pupils with the occupational opportunities available in the automobile industry.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a knowledge of the variety of occupational opportunities in the automobile industry. Suggested fields are: Automobile Industry Occupations Professional and technical occupations Engineer Chemists Metallurgists Physicists Mathematicians Statisticians Administrative, Clerical and related occupations Executives Plant Mgrs. Personnel Mgrs. Purchasing Accountants Lawyers Market analysts Economists Plant Occupations Machining Foundry Forging Inspection Finishing Materials handling, custodial and plant protection Maintenance Automobile Service Occupations Automotive Mechanic Specialty Mechanic Shop Foremen Service Manager Sales Manager Salesman Parts Manager	a. Information sheets on various occupations. b. Assignment sheet - explore an occupation of pupil's choice. c. Discuss relation of occupations to the experiences to be gained in the laboratory. d. Invite speaker from the automobile or service industries. e. Show occupational films on the automobile industry and automobile servicing and the educational requirements for the worker.

Objective: 2. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
1. (cont.) Automobile Service Occupations (cont.) Jobber Salesman Technical Teacher Driver of truck or bus Insurance Adjuster Owner of service station Automobile dealer	
2. He will have a knowledge of requirements and occupational choice factors to consider in selecting an occupation.	a. Assign readings on occupations in guidance bulletins, automobile company reports, etc. b. Have the pupil make a list of personal qualities desired of a worker in the industry and discuss the same.
3. He will realize the role unions play in the automobile industry and automotive servicing.	a. Have pupil investigate and discuss the unions involved in the manufacturing and servicing of automobiles. b. Use a local union officer as a resource person to discuss the importance of unions to the worker.

Objective: 3 To develop in each pupil an understanding of the basic principles of thermal power and its application to products used in our society.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a basic and thorough understanding and working knowledge of general theories of operation of the following power plants. 2 and 4 cycle engine diesel engine jet engine steam turbine gas turbine rocket engine steam engine aircraft engine atomic engine NOTE: Material covered in previous unit. However, applications to the automobile should be pointed out.	a. Lessons - On the general theories of operation (carburetion, compression, ignition) of the 2 and 4 cycle engine, diesel, jet, steam turbine, rocket, gas turbine, steam, aircraft and atomic engines. b. Have pupil draw diagrams explaining the theory and operation of the following power plants. 2 & 4 cycle engine diesel engine jet engine steam turbine gas turbine rocket engine steam engine aircraft engine atomic engine c. Show films - G.M.C. "ABC of Internal Combustion" "ABC of Diesel Engine" "ABC of Jet Propulsion" d. Have a panel discussion on the merits of the various types of engines. (Gasoline, steam, diesel, and atomic engines should be represented.)
2. He will become familiar with the components of the automobile engine .	a. Lessons on the purpose and function of the following: 1. fuel system 2. ignition system 3. lubrication system 4. cooling system 5. electrical system b. Lessons on how to remove, clean, check, replace and test various components of the automobile engine .

Objective: 3. (Cont.)

Expected pupil behavioral change	Suggested activities to implement the change
2. (Cont.)	c. Information sheets -- 1. fuel system 2. ignition system 3. cooling system 4. adjusting a carburetor 5. Ohm's Law 6. electrical symbols 7. chemical action in a storage battery 8. automotive electrical system
	d. Have pupil calculate compression ratio.
	e. Have pupil calculate horsepower of an automobile engine.
	f. Have pupil determine boiling point of water under pressure in an automobile radiator.
	g. Have pupil calculate the number of times that ignition points open during a specified length of time.
3. He will become familiar with the other components of the automobile.	a. Lessons on the construction, purpose and function of the following: 1. Framework 2. Power train 3. Body 4. Accessories
	b. Assignment sheets on the following: 1. Clutches 2. Transmissions 3. Drive lines 4. Rear axles 5. Suspension system 6. Steering system 7. Tires and tubes

Objective: 3. (Cont.)

Expected pupil behavioral change	Suggested activities to implement the change
3. (Cont.)	c. Have pupil compute "stopping distances" at various speeds. d. Have pupil calculate amount of hydraulic pressure on brake drum. e. Have pupil calculate the difference in revolution between the inside and the outside wheel while in a turn.

Objective: 4. To develop in each pupil a degree of skill in applying basic principles of thermal power.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use cutting, holding, measuring, pounding and assembly tools and procedures.	a. Lessons over cutting, holding, measuring, pounding and assembly tools needed in the repairing of power plants.
	b. Have pupil locate and name the cutting, holding, measuring, pounding and assembly tools he will use.
2. He will recognize and use testing instruments and procedures.	a. Lessons on testing instruments needed in the repairing of power plants.
	b. Have pupil locate, name and explain operation of testing instruments he will use.
3. He will recognize and use machines and procedures.	a. Lessons over machines needed in the repairing of power plants.
	b. Have pupil demonstrate safe operation of machines he will use.
4. He will become familiar with the components of the automobile engine.	a. Have pupil disassemble, examine, reassemble, run and test the components of the automobile engine.
	b. Have pupil read about the various components of the automobile engine.
	c. Use visual aids to show operating principles of components of the automobile engine.

Approach:

1. Have the class participate in a discussion centered around thermal engines and their effects on our society.

2. Have an automobile or outboard engine operating with some malfunction so as to create a discussion on the importance of understanding the operating principles of the automobile.

3. Field trips to automobile assembly plant and service garage.

4. Show film Up From Clay, G.M.C. This film shows the scope of modern automobile body building operations. From the stylist through to the clay mock-up to the final production and testing.

Activities:

The principal activity through which the objectives of this unit will be achieved will consist of study and work with automobile engines.

Suggested:

1. Automobile Engine Operating Principles

A. Cooling system

1. Drain and flush (reverse flush if possible)
2. Remove thermostat and test - replace
3. Check all hoses and clamps
4. Check fan belt and adjust tension
5. Check water pump
6. Refill cooling system
7. Test anti-freeze solution

B. Lubrication system

1. Check crankcase oil level
2. Check oil condition
3. Add or change oil as necessary
4. Check oil filter, replace if necessary
5. Check for engine oil leaks
6. Inspect oil pump

C. Fuel System

1. Check system for leaks, kinked tubing, and loose parts
2. Clean sediment bowl
3. Check fuel pump vacuum and/or pressure
4. Clean carburetor strainer and float chamber
5. Adjust carburetor for proper carburetor at idle speed
   (Engine tester should be used)
6. Disassemble and inspect a carburetor
   (Use the one reserved for this operation)

Activities: (Cont.)

I. Automobile Engine Operating Principles (Cont.)

D. Engine Construction and Component Parts

1. Remove head and inspect
2. Remove oil pan and inspect
3. Remove crankshaft and inspect crankshaft and bearings
4. Remove one piston rod assembly and inspect bearings, rod, wrist pin, and rings (complete disassembly) reassemble using Plasti-gage to check bearing clearance

5. Remove one intake and one exhaust valve and inspect
6. Inspect valve timing mechanism
7. Reassemble engine
8. Check valve clearance on an operating engine
9. Reface one valve and one seat

II. Automobile Electrical System

A. Ignition

1. Inspect condition of wiring
2. Clean and adjust points (replace if needed)
3. Check contact point pressure
4. Inspect rotor and distributor cap
5. Lubricate distributor
6. Check automatic advance units (use distributor checking machine)
7. Clean and adjust spark plugs
8. Check primary and secondary ignition wiring
9. Test coil
10. Test condenser
11. Check compression of each cylinder
12. Time engine (all wires from spark plug to distributor must be removed first)
13. Test engine for miss while running by
    a. shorting out each plug

Suggested Texts:

Allen, Willard A. *Know Your Car*. Chicago, Ill.: American Technical Society, 1960.

Beeler, Samuel C. *Understanding Your Car*. Bloomington, Ill.: McKnight and McKnight Publishing Co., 1958.

Crouse, William H. *Automotive Mechanics*. New York: McGraw-Hill Book Co., Inc. 1960.

Glenn, Harold T. *Exploring Power Mechanics*. Peoria, Ill.: Chas. A. Bennett Co., Inc., 1962.

Glenn, Harold T. *Automechanics*. Peoria, Ill.: Chas. A. Bennett Co., Inc., 1962.

Purvis, Alfred J. *All About Small Gasoline Engines*. Homewood, Ill.: The Goodheart-Willcox Co., Inc., 1956.

Stephenson, George E. *Power Mechanics*. Albany, N. Y.: Delmar Publishing Co., Inc., 1963.

Storkel, Martin W. *Auto Mechanics Fundamentals*. Homewood, Ill.: The Goodheart-Willcox Co., Inc., 1963.

Resource Materials:

Blanchard, Harold F. and Ritchen, Ralph. *Motor's Auto Repair Manual*. New York: Motor (250 West 55th Street), 1962.

Crouse, William H. *Automotive Engines*. New York: McGraw-Hill Book Co., Inc., 1959.

Jensen, Louis E. and Brazier, William A. *Related Science - Automotive Trades*. New York: Delmar Publishers, Inc., 1958.

Kuns, Ray F. *Automotive Essentials*. Milwaukee, Wis.: Bruce Publishing Co., 1958.

Motor's Auto Repair Manual. New York: Motor (250 West 55th Street), 1960.

S. A. E. Handbook. New York: Society of Automotive Engineers, Inc. (485 Lexington Avenue) 1958 - 1962.

Toboldt, William K. and Purvis, Jud. *Automotive Encyclopedia*. Chicago, Ill.: The Goodheart-Willcox Co., 1962.

Venk, Ernest A. *Automotive Fundamentals*. Chicago, Ill.: American Technical Society, 1961.

Booklets, Manufacturers: (Suggested partial list)

ABC's of Hand Tools, General Motors Corp., Detroit, Michigan, 1945.
How's Your "Safety Rating" When You Work With Tools, Snap-on Tools Corp., Kenosha, Wisconsin, 1958.
A Car is Born, Ford Motor Co., Dearborn, Michigan, 1955.
Power Goes to Work, General Motors Corp., Warren, Michigan, 1955.
Power Primer, General Motors Corp., Detroit, Michigan.
Micrometer Reading Made Easy, Lufkin Rule Co., Saginaw, Michigan

Booklets, Manufacturers: (Suggested partial list) - Continued.

Diesel - The Modern Power, General Motors Corp., Detroit, Michigan, 1944.
Prescription for Better Gasoline Engine Overhaul, Perfect Circle Corp., Hagerstown, Indiana, 1961.
The Inside Story of Engine Oiling. Chrysler Corp., P. O. 1919, Detroit 31, Mich.
The Engine Cooling System, Union Carbide Corp., 270 Park Ave., New York 17, N. Y.
Allen Course of Modern Tune-up, Allen Electric and Equipment Co., Kalamazoo, Mich.
Introduction into Automotive Electrical System, Delco-Remy Div., General Motors Corp. Anderson, Indiana. Many other booklets on the electrical system may be obtained. from this company.

Tools and Equipment: (Suggested partial list)

Chisels-a. cape chisel, b. cold chisel, c. diamond point chisel, d. half round chisel, e. round nose chisel.

Drilling tools-a. hand drill, b. electric drill, c. twist drills, d. reamers.

Files-a. mill file, b. taper file, c. square file, d. round file, e. half round file, f. breaker point file, g. vixen cut (body) file

Hammering tools-a. ball peen hammer, b. rawhide faced mallett, c. plastic tipped mallett, d. brass mallett, e. rubber mallett, f. sledge hammer.

Measuring tools-a. feeler gauges, b. micrometers, c. steel rules.

Pliers-a. combination slip-joint pliers, b. diagonal cutting pliers, c. long nose pliers, d. round nose pliers, e. pump-type pliers, f. side-cutting pliers, g. vise-grip pliers, h. brake spring pliers.

Punches-a. aligning punch, b. center punch, c. pin punch, d. starting punch

Saws - a. hacksaw

Screwdrivers-a. conventional screwdriver, b. phillips screwdriver, c. clutch screwdriver, d. offset screwdriver, e. setscrew driver (allen wrench)

Shearing tools-a. straight shears, b. combination shears, c. duckbill shears, d. aviation shears

Soldering tools-a. electric and standard soldering coppers, b. fluxes

Threading tools-a. taps and dies

Wrenches and handles-a. open-end wrench, b. box-end wrench, c. socket wrench (1) standard, (2) deep, (3) universal, d. torque wrench, e. adjustable-end wrench, f. monkey wrench, g. pipe wrench, h. handles (1) speed (spinner) handle, (2) ratchet handle, (3) flex (break-down) handle, (4) tee handle, i. extensions.

Tools and Equipment: (Continued)

Anti-freeze; tester; air gauge; valve core removing tool; battery hydrometer; wire brushes; piston ring compressor; piston ring expander; valve ring compressor, gear pullers; battery terminal puller; tubing cutter; tool flaring set; battery post cleaner and cable terminal reamer; battery strap carrier; brake bleeder tube; grease gun; suction gun; auto. creepers; jack stands; brake adjusting tools; point spring tension gauge; spark plug cleaner and tester; oil filter removing tool; impact wrench; wheel balancer (static) carburetor and distributor tools; headlamp intensity meter; automobile and outboard engines; various components of the automobile.

Materials and Supplies: (Suggested partial list)

Grease and lubricants (chassis, rubber lub, engine oil, stick lub, cup grease); brake fluid; rust inhibitor; anti-freeze; gasoline; kerosene; bicarbonate of soda; cloths; tire patching kit; stick of chalk; fuses; bulbs; tire weights.

Lessons to be Taught:

Manipulative lessons

This list of lessons was taken from the analysis of objectives and is listed in the nature of general statements of work to be taught rather than in specific titles.

1. Cooling system job.
2. Lubrication system job.
3. Fuel system job.
4. Engine construction and check-up job.
5. Ignition and electrical job.
6. Trouble shooting.
7. Lessons on those hand tools and machine tools and testing instruments to complete the activity.
    - a. cutting tools
    - b. holding tools
    - c. measuring tools
    - d. pounding tools
    - e. assembly tools
    - f. service machines
    - g. diagnosing equipment

Related lessons

This list of lessons was taken from the analysis of objectives and is listed in the nature of general statements of work to be taught rather than in specific titles.

It should be noted that this list does not include films, discussions, and other teaching methods suggested to achieve the behavior changes.

1. The automobile industry - history and development.
2. Importance of the automobile industry.
3. Vertical and horizontal integration.
4. Evaluating a car.
5. Principles of automobile design.

Lessons to be Taught: (Continued)

Related lessons (continued)

6. Financing an automobile.
7. Automobile insurance and its importance.
8. Laws regarding automobile insurance.
9. Organizational structure of the automobile industry.
10. Occupational opportunities in the automobile industry - meeting requirements.
11. Servicing opportunities - meeting qualifications and requirements.
12. Role of unions in the industry.
13. Operating principles of internal and external thermal (heat) engines.
14. Function and purpose of the following components of the automobile: fuel, ignition, lubrication, cooling and electrical system.
15. Function and purpose of the following components of the automobile: framework, power train, body and accessories.
16. Calculating compression ratios.
17. Calculating horsepower.
18. Computing stopping distances.

Teaching Aids and Devices:

Training charts and manuals

Delco-Remy Fundamentals of Electricity and magnetism
Delco-Remy Storage Batteries
Delco-Remy Cranking Motors and Series Parallel Switches
Delco-Remy The Ignition system
Delco-Remy Generators
Delco-Remy Standard Duty Generator Regulator

Hand books

Delco-Remy Operation and Maintenance Handbook
Delco-Remy Test Specifications

Delco-Remy Film Kits 35 mm Slide (includes film, record and reader's script or booklet)

Battery Ignition
Standard Duty Generator Regulators
Introduction to Automotive Electrical System
20,000 Volts Under the Hood (The ignition circuit)
The cranking circuit

Films

General Motors Corporation
Public Relations Staff-Film Library   Pay postage one way
General Motors Building
Detroit, Mich. 48202

Films (Continued)

The ABC of Internal Combustion - An animated motion picture explaining the basic principles of the internal combustion engine.

The ABC of the Automobile Engine - An animated motion picture explaining in graphic detail the parts and working of the modern automobile engine.

Where Mileage Begins - How an automobile engine works and how it is assembled.

Up From Clay - A beautifully photographed story of automobile body-building.

Member of the Family - How each yearly new model automobile is treated as a brand new design.

Matter of Responsibility - The story of GM's reliability program to assure more dependable products.

Firebird III - New ideas take shape in ultra-advanced experimental car.

Cross Section of America - Scientific automobile testing at the GM Proving Grounds.

Temperatures Made to Order - The story of heat control in liquid-cooled automobile engines.

Challenge and Response - A comprehensive insight into modern industrial research.

Easy Street - How new research studies may shape our driving techniques in the future.

Our American Cross roads - Fifty years of American history are compressed into half an hour to show the role of the automobile in changing our way of life.

Giants in the Land - An inspiring film which tells in song and color pictures the dramatic story of a modern day Paul Bunyan - Diesel Engine.

Change for the Better - A whimsical but informative story of the used car - as told by one of them.

The Miniature Sphere - The story of the latest type ball bearings and their production.

Handle with Care - A new color film teaching mechanics how to remove, inspect, service and install ball bearings.

Oil Films in Action - A technical film prepared for practicing engineers, designers, and students to show how oil films behave in bearings.

Teaching Aids and Devices: (Continued)

Wallcharts:

Wallcharts make excellent bulletin board devices for illustrating the history and development and application of heat engines. In some of the charts operating principles are well illustrated. They are provided by the following companies free of charge.

Automotive Manufacturers Association
320 New Center Bldg.
Detroit, Michigan

Ford Motor Company
The American Road
Dearborn, Michigan

The DoAll Company
254 N. Laurel Avenue
Des Plaines, Illinois

General Motors Corp.
Detroit, Michigan
Public Relations Staff

Evaluation Techniques:

1. Observation (teacher)
2. Performance test.
3. Safety test.
4. Class discussion.
5. Assignments and reports.
6. Study guides.
7. Activity sheets.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavior changes listed in the analysis of the objectives have been accomplished.

Title of Unit: Residential Wiring

Introduction:

Electricity has been a vital force in America's tremenious technological development over the past 75 years. It not only provides power for the production of the nation's goods and services, but also heats, cools, and lights homes, offices, factories and farms. More than 60 million customers are served today by our electric utility systems.

Many different types of workers are needed to provide and maintain electric utility services. Through this unit we hope to acquaint the pupil with a variety of occupations and give an introduction into the principles and technical knowledges of the residential and industrial wiring and equipment industry. With this background we hope to aid the pupil to become a better productive member of our industrial society.

Scope:

a. 11th grade

b. 3 - 6 weeks (suggested)

c. 280 minutes (min.)

Objectives

1. To develop in each pupil an insight and understanding of residential wiring and its place in our society.

2. To discover and develop pupil interests and talents in residential wiring and related industries.

3. To develop in each pupil an understanding of the basic principles of electricity involved in residential wiring.

4. To develop in each pupil problem-solving abilities related to the materials, processes and products of residential wiring.

5. To develop in each pupil a degree of skill in the safe use of tools and equipment involved in residential wiring.

Objective: 1. To develop in each pupil an insight and understanding of residential wiring and its place in our society.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have an understanding of the importance of this industry in our society.	a. Lesson on the importance of the power industry in our society. b. Show films on how electricity is produced. c. Discussion on Federal, State and Local interests in the power industry.
2. He will understand how an electrical company is organized.	a. Lesson on the general organization of the electrical company. b. Field trip to local industry.
3. He will realize the factors that influence plant location.	a. Have pupil do a research paper on factors that influence plant location.
4. He will realize the services this industry performs for the consumer.	a. Assign a research paper on services this industry performs for the consumer.

Objective: 2. To discover and develop pupil interests and talents in residential wiring and related industries.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a knowledge of the variety of opportunities in light and power industry. Suggested fields are: Powerplant occupations Boiler operators Turbine operators Auxiliary equipment operators Switchboard operators Watch engineers Transmission & Distribution Occupations Load dispatchers Substation operator Linemen Groundmen Troublemen Cable splicers Customer service occupations Meterman Meter installers Meter testers Meter readers District representatives Appliance servicemen Construction occupation Electrician	a. Information sheets. b. Have pupil prepare a guidance folder on an occupation of his interest in the light and power industry. c. Show films on these various occupations. d. Invite a representative of a local power company to explain some of these job opportunities in this industry. e. Discuss the entrance requirements, working conditions, training and wages of the various occupations in this industry.

Objective: 3. To develop in each pupil an understanding of the basic principles of electricity involved in residential wiring.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will understand the basic principles of magnetism.	a. Demonstrate with two bar magnets the principles of repulsion and attraction.
	b. Lesson on how magnetism is converted into electricity and how electricity is converted into magnetism.
	c. Have pupil construct a simple electromagnet.
2. He will understand how electrical energy is converted into mechanical motion and this is used in industry.	a. Lesson on changing magnetism into motion by attraction and repulsion.
	b. Lesson on how an electric bell operates.
	c. Have pupil make a wet cell.
	d. Have pupil draw a dry cell and label its parts.
	e. Have pupil construct a continuity tester.
3. He will know how electric current is measured, computed and used.	a. Lesson on Ohm's Law.
	b. Lesson on how electricity flows along a conductor.
	c. Lesson on the electron theory.
	d. Lesson on measuring current flow.
4. He will know how voltage is produced, measured and controlled.	a. Lesson on what is voltage and how it is produced.
	b. Lesson on measuring voltage.

Objective: 3. **(Continued)**

Expected pupil behavioral change	Suggested activities to implement the change
5. He will know how current flow is affected by resistance.	a. Lesson on resistance - what it does and how it is used.
	b. Lesson on measuring resistance.
	c. Have pupil build a rheostat.
	d. Review lesson on current, voltage and resistance.
6. He will know the conductors and insulators of electricity.	a. Have pupil make a list of good and poor conductors and insulators.
	b. Lesson on the flow of electricity along a conductor.
	c. Discussion on the carrying capacity of various sizes of wire.
7. He will understand the operation of parallel, series and series-parallel circuits and where they are used.	a. Lesson on various types of circuits used in the home.
	b. Demonstrate and show series, parallel and series-parallel circuits.
	c. Have pupil connect lamps in series.
	d. Have pupil connect lamps in parallel.
	e. Have pupil connect lamps in series-parallel.
	f. Lesson on use of meters in checking these circuits.
8. He will know how electric energy is measured and computed.	a. Lesson on how to measure electrical energy.
	b. Lesson on computing the cost of electrical energy.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
9. He will know how electrical power is produced and distributed for residential and commercial use.	a. Field trip to nearby power plant. b. Have pupil prepare a report on the production and distribution of electrical power. c. Lesson on how electricity is made and brought to the users.
10. He will have some knowledge of the National Electrical Code.	a. Lesson on the National Electrical Code.

Objective: 4. To develop in each pupil problem-solving abilities related to the materials, processes and products of residential wiring.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will learn to read and interpret symbols, sketches and working drawings used in the residential and industrial wiring and equipment industry.	a. Give lesson on various electrical symbols used in the electrical industry.
	b. Have pupil make schematic drawings of electrical circuits of residential home or commercial building.
	c. Have pupil study, understand and use the National Electrical Code book for correct wiring procedures.
2. He will learn to sketch and plan the wiring of a prepared floor plan.	a. Lesson on making an electrical schematic plan for a home or building.
	b. Have pupil prepare a schematic plan for a home or building using a prepared floor plan.
3. He will know how to study a schematic of a home or building, plan for circuit load and then determine and figure the cost of materials to do the job.	a. Lesson on circuit load (home lighting requirements).
	b. Lesson on various materials used in power installations.
	c. Use reliable electrical wholesale catalogs for listing materials to be used on this job.
	d. Assign pupil to list and figure cost of materials needed for this job.
4. He will know how to plan the circuits and wire a residential home or building.	a. Have pupil wire small building.
	b. Have pupil follow his schematic plan very carefully.
	c. Have pupil locate and mount boxes in the residential home.
	d. Have pupil drill holes in studding to go to these boxes.
	e. Have pupil figure the number of circuits this job is going to require.

Objective: 4. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
4. (Continued)	f. Have pupil run wires for various circuits from main entrance to boxes.
	g. Have pupil install main entrance.
	h. Have pupil install various fixtures. (after finish work is completed in the home or building)
	i. Have pupil test and check out the complete installation.
5. He will have a knowledge of the controlling devices used by this industry.	a. Discussion on the operation of the following devices: rheostats motors fuses filaments vacuum tubes switches transformers

Objective: 5. To develop in each pupil a degree of skill in the safe use of tools and equipment involved in residential wiring.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use layout, cutting, forming, holding and assembly tools and procedures.	a. Lessons over layout, cutting, forming, holding and assembly tools needed in the wiring of a home or building.
	b. Have pupil locate and name the layout, cutting, forming, holding and assembly tools he will use.
2. He will recognize and use testing instruments and procedures.	a. Lessons over testing instruments needed in the wiring of a home or building.
	b. Have pupil locate and name the testing instruments he will use.
3. He will recognize and use machines and procedures.	a. Lessons over machines needed in the wiring of a home or building.
	b. Have pupil demonstrate safe operation of a machine he will use.
4. He will care for tools and equipment.	a. Have pupil return tools and equipment to proper place as soon as he finishes using them.

Approach:

1. Show film on wiring a home.
2. Have a union electrician talk to pupil on codes and standards in the electrical field.
3. Visit a new home that is under construction - point out wiring procedures.
4. Visit a new commercial building under construction - point out wiring procedures.
5. Demonstrate the importance of following codes in wiring by blowing a fuse.

Activities:

The principal suggested activity for this unit is the planning and wiring of a small building built by the construction group in the 10th grade. This unit should stress the making of schematics and working drawings, planning a wiring job, ordering the materials needed and then doing the wiring job.

Suggested Texts:

Arnold, Joseph P. and Schank, Kenneth L. Exploratory Electricity. Illinois: McKnight & McKnight Publishing Co., 1960.

Graham, Kennard C. Interior Electrical Wiring. Chicago: American Technical Society, 1961.

Mix, Floyd. All About House Wiring. Chicago: The Goodheart-Willcox Co., Inc., 1959.

Richter, H. P. Wiring Simplified. Minneapolis 8, Minn.: Park Publishing Co., 1959.

Stieri, Emanuele. Electricity in the Home. New York: Barnes & Noble, Inc., 1960.

Suffern, Maurice Grayle. Basic Electrical Principles. New York: McGraw-Hill Book Company, Inc., 1956.

Resource Material:

Buban and Schmitt, Understanding Electricity and Electronics. N.Y.: McGraw-Hill, 1962

Graham, Frank D., Audels New Electric Library. N. Y.: Theo. Audel & Co., 1960.

Graham, Kennard C., National Electrical Code and Blueprint Reading. Chicago: American Technical Society, 1961.

Kitts, Harry W. Nabben, Marvin, Farm Electricity. Albany: Delmar Pub. Co., 1960.

Steinberg and Ford, Electricity and Electronics-Basic. Chicago: American Technical Society, 1961.

Uhl-Dunlap-Flynn, Interior Electric Wiring and Estimating. Chicago: American Technical Society, 1954.

Tools and Equipment:

1/2" power drill; Electrician's drill bits; Side cutting pliers; Round nose pliers; Test bell; A.C. voltmeter 0 - 300; 1/4" power drill; Hack saw--Asso. blades; diagonal pliers; test lamp (continuity); Watt hour meter; A.C. ammeter 0 -- 100; Multimeter; Pipe wrench; Hammers; Corner brace; Screwdrivers (Phillips); Wood chisels; Shop vise; Keyhole saw; Short step ladder; Center punch; Tape rule; Fishing wire or tapox; Files; Plumb bob; Wire stripper; Bit brace; Screwdrivers (assort.); Cold chisels; Conduit bender (Hicky); Combination saw (Assort. blades); Bench and other shop tools; Saber saw; Variable resistor; Soldering iron; Adjustable wrench; Spirit level; Electrician's pocket knife; Nail puller.

Materials and Supplies:

Nails (assort.); Tape (friction - plastic); Utility boxes; Wall boxes; Switches S_1, S_3, S_4; Couplings; Connectors; Range outlet; Pull switches (Receptacles); Screws (assort.); wire nuts (3 sizes); ceiling boxes; Junction boxes (2 sizes); Surface plate; Service box (disconnect); Fuses (plug and cartridge); Duplex outlets.

Lessons to be Taught:

Manipulative Lessons

This list of lessons was taken from the analysis of objectives and includes those lessons which enable the student to carry on the activities suggested by the unit.

1. Making a schematic of a home or building.
2. Planning the wiring job from a floor plan.
3. Making a material list.
4. Locating and mounting boxes.
5. Running wires.
6. Installing a main entrance.
7. Installing various fixtures.
8. Testing and checking out complete installations.
9. Layout, cutting, forming, holding and assembly tools and procedures.

    a. Recognize and select.
    b. Name correctly.
    c. Use properly and safely (Extent needed in wiring the home)

10. Testing instruments and procedures.

    a. Recognize and select.
    b. Name correctly.
    c. Use properly and safely (Extent needed in wiring the home)

11. Machines and procedures.

    a. Recognize and select.
    b. Name correctly.
    c. Use properly and safely (Extent needed in wiring the home)

Lessons to be Taught: (Continued)

Related Lessons

This list of lessons was taken from the analysis of objectives and is in the nature of general statements of information to be taught rather than specific titles. It should be noted that this list does not include films, discussions, and other teaching methods suggested to achieve the behavior changes.

1. The importance of the power industry in our society.
2. General organization of an electrical company.
3. How magnetism is converted into electricity and how electricity is converted into magnetism.
4. Principles of magnetic repulsion and attraction.
5. Changing magnetism into motion by attraction and repulsion.
6. Operating principles of an electric bell.
7. Ohm's Law.
8. Flow of electricity around a conductor.
9. Electron theory.
10. What is voltage, current and resistance.
11. Measuring voltage, current and resistance with meters.
12. Conductors and insulators.
13. Various types of circuits in the home.
14. Series, parallel and series-parallel circuits.
15. Testing circuits with various meters.
16. Measuring electrical energy.
17. Computing cost of electrical energy.
18. How electricity is made and brought to the users.
19. National Electrical Code.
20. Electrical symbols.
21. Figuring circuit load.
22. Characteristics of various electrical materials.
23. Figuring the number of circuits for the home.

Teaching Aids and Devices:

Chart -- Circuit for fluorescent lamp. (Teacher/pupil made).
Display board -- Surface mounted materials. The Wiremould Co.
Kilowatt-hour meter. Local Power Co.
Mock-up of automatic washing machine. Pupil made. Ref. 3-Dimensional Teaching Aids. U. S. Dept. Ed. Wash. D. C.
Mounted board of cable designs and conduit types. (Pupil made)

Films:

The Dawn of Better Living. 16mm, sound, color, 16 min. A Walt Disney cartoon of 300 yrs. of progress to modern electric homes. Shows need for adequate wiring. Westinghouse Elec. Corp. P. O. Box 2278, Pittsburg, Pa.

Principles of Electricity. 16mm, sound, color, 20 min. A review of principles of electricity, electric current, magnetism, volt, ampere and Ohm. Explained in animation. U. of M. Film Library, Orono, Me. Rental, $2.50.

Teaching Aids and Devices: (Continued)

Films: (Continued)

A. B. C. of Hand Tools. General Motors Corp.

Organization chart of an industry. (Teacher made)
Cut-away charts-Moving coil meters (4 charts) Weston Inst. Co.
Isometric cut-away chart of electric stove and refrigerator. (Westinghouse Co.)
Current carrying capacity of wire chart. (Teacher/pupil made)
Sliding scale rate chart. (Cost of KW for the area). Apply local power Co.
Wattage consumed by common devices and appliances. Apply local power Co.

Evaluation Technique:

Evaluation of this unit will be difficult because of the nature of the material to be presented. However, some of the criteria for evaluation is listed below:

1. Attitude and initiative of the pupil as he works in the shop.
2. Degree of success of each pupil in fulfilling the requirements of the course or unit.
3. Several brief quizzes during the unit.
4. Written assignments or reports as required by the instructor.
5. Unit evaluation upon completion of the unit.
    a. True-False.
    b. Completion.
    c. Multiple choice.
    d. Matching questions.
    e. Identification of tools or equipment.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavioral changes listed in the analysis of the objectives have been accomplished.

Title of Unit: Wire and Wireless Communication

Introduction:

The field of communications, or the communications industry, as it is sometimes called, refers to the production, manufacture, installation, and maintenance of telephone, telegraph, wireless, and cable equipment, and of radio, television, and radar broadcasting equipment.

The vast radio and television, telegraph and telephone networks employ directly hundreds of thousands of persons. They also create employment for many thousands of others who work to produce and manufacture the equipment necessary to operating the systems.

It is important that pupils have an understanding of the role that communications plays in our society and how commerce and industry, news and entertainment, police and welfare work, transportation and national defense, depend today upon these various communications systems for their efficient operation.

Scope:

a. 11th grade

b. 12 - 18 weeks (suggested)

c. 280 minutes per week (Min.)

Objectives

1. To develop in each pupil an understanding of the role of communications in their daily lives.

2. To discover and develop pupil interests and talents in the field of communications.

3. To develop in each pupil an understanding of the basic principles and operations involved in communications.

4. To develop in each pupil problem-solving abilities related to the materials, processes and products in communications.

5. To develop in each pupil a degree of skill in the safe use of tools and equipment used in communications.

Objective: 1. To develop in each pupil an understanding of the role of communications in their daily lives.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will gain an insight into the various methods of communication which we use today.	a. Read and do assigned research papers on the communication fields, their origins and developments.
2. He will have a knowledge of the many job opportunities to be found in the communications field.	a. Have speakers come in to talk to the group about their jobs, working conditions and necessary education and preparation for those fields.
3. He will have an understanding of the nature and extent of the electronics manufacturing industries.	a. Lesson on the five major categories of electronic manufactured products. 1. military equipment. 2. consumer products. 3. industrial and commercial equipment. 4. electron tubes and semi-conductor devices. 5. other electronic components.
4. He will know how electronic products are made.	a. Have pupil select a piece of communication equipment and have him analyze how it was manufactured.

Objective: 2. To discover and develop pupil interests and talents in the field of communications.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a knowledge of the variety of occupations in the communications industry. Suggested fields are: production maintenance transportation service engineering scientific administrative clerical sales	a. Information sheets. b. Have pupil prepare a guidance folder covering one of the occupations of this industry. c. Invite a speaker from a communication industry to discuss the various job opportunities in this industry. d. Have pupil discuss different methods of locating and selecting a suitable job.
2. He will realize the role of unions in the communications industry.	a. Have local electrical union officers discuss the importance of unions to management and labor.

Objective: 3. To develop in each pupil an understanding of the basic principles and operations involved in communications.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will develop an understanding of magnets and magnetism.	a. A lesson on the fundamentals of magnets and magnetism with demonstrations. b. Construct, for demonstration purposes, an electromagnet and magnetize other materials. c. Complete in a notebook the evaluation of the above experiments and outside readings. pp 163-182 in Ref. #2.
2. He will develop an understanding of the electron theory and its relationship to electricity.	a. Lesson on the electron theory and readings in text #2, pp 115-143. b. Preparation for notebook, diagrams showing the following: Hydrogen Atom, Helium Atom, a positive ion, a negative ion, and how a capacitor appears charging and discharging.
3. He will develop an understanding of the sources of electricity from heat, chemical, and mechanical means.	a. Study in Ref. #2, pp 208-228. b. Lesson on current generation. c. Field trip to hydro-electric plant. d. Prepare for notebook drawings of the following: wet cell battery, dry cell battery and solar cell.
4. He will use test instruments to measure Direct Current.	a. Lesson meters, types of movements and their uses. b. Use of V O M to take readings of voltage and resistance. c. Use a V T V M to take readings of current, resistance and voltage.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
He will be able to prepare wiring diagrams and circuits.	a. Lesson on parallel circuits. b. Lesson on series circuits. c. Read pp. 146-151 in Ref. #2 or Chapter 14 in Ref. #3.
6. He will be able to solve simple problems involving Ohm's and Watt's Laws.	a. By demonstration with volt meters, lamps, and rheostats, show general basic principles. b. Class lesson on voltage sources, current, resistance, set up a series of problems for solving.
7. He will know about transformers, their uses, operation and construction.	a. Lesson on electromagnetic induction and its relationship to transformers. b. Read unit #32 in Ref. #2. c. Design and construct a small transformer. (Suggested format given pg. 394, Ref. #2).
8. He will be able to identify components, resistors and capacitors.	a. Lesson on resistors for purpose of reading color codes. b. Lesson on capacitors for purpose of reading color codes. c. Read assigned readings in Ref. #2.

Objective:3 (Continued).

Expected pupil behavioral change	Suggested activities to implement the change
9. He will know the construction, use and limitations of telephone communication.	a. Describe in a lesson, the microphone that is used in the telephone.
	b. Construct a simple carbon microphone (each pupil may attempt this).
	c. With use of charts or board, show the construction of the telephone handset.
	d. Read unit 49 in Ref. #2 and for notebook copy diagram #49-4 and answer questions on page 312.
	e. Show the circuits of a telephone and how they are connected.
	f. Secure, if possible, telephone handsets, of the local battery type, and connect them to form a small telephone communications set-up.
10. He will know the operation of the telegraph and telegraph systems.	a. A lesson on the equipment used to send and receive telegraph messages. (manual type)
	b. Construct a simple key and sounder or buzzer for a project to be used by the student.
	c. Connect keys and actually send messages.
	d. Read in Ref. #2, Unit 48, pp 304 to 306. Answer questions on p. 307.
11. He will develop an understanding of the types, uses and capabilities of public address and intercommunication systems.	a. Lesson on common systems in use today.
	b. Lesson on amplifiers. 1. Power capabilities. 2. Set-up and problems.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
11. (Continued)	c. Lesson on inputs. 1. Microphone. 2. Record players. 3. Tape recorders.
	d. Lesson on speakers, types, uses--capabilities and limitations.
	e. Demonstration lesson on hooking up P. A. systems showing and/or describing hazards and problems that are common to their use and operation.
	f. Describe and show, if possible, examples of the intercom systems in previous discussions.
12. He will develop an understanding of a phase of the electronics industry through the study of radio principles.	a. Conduct an introductory lesson with a reading assignment from Ref. #3, Unit 29.
13. He will have a knowledge of resonant circuits.	a. Lesson on resonant circuits with examples of how and where used.
	b. Show by demonstration the voltage measurement in parallel tuned circuits by varying inductance and/or capacitance.
	c. Have pupil build walkie-talkie units.
	d. Have pupil build radio-controlled units (cars, etc.).
	e. Have pupil build and operate a ham radio station.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
14. He will develop an understanding of coupled circuits.	a. Lesson on coupling methods with a discussion of advantages and limitations of the various types.
15. He will have a knowledge of linear circuits.	a. A lesson and demonstration on coupled resonant circuits to show the effect on selectivity.
16. He will have a basic understanding of vacuum tubes, symbols, types and functions of the various circuits.	a. A general lesson on vacuum tubes showing symbols used for various types and the tube names from their function in circuits.
17. He will have a knowledge of how amplification is accomplished using vacuum tubes.	a. A lesson and demonstration to show how a triode tube can be used to amplify a signal.
	b. A lesson to show the classes of amplifiers and where used.
18. He will have an understanding of multielement tubes and their advantages and disadvantages.	a. A lesson on "multi-element" tubes to show why they were developed.
19. He will have an understanding of how a signal wave is produced.	a. A lesson on oscillators and transmitters.
	b. A demonstration of how the oscillator and transmitter function.
	c. Construct an oscillator and/or simple transmitter and use dummy load to show that they are functioning. NOTE: The Federal Communications Commission requires that a licensee only connect a transmitter or oscillator to a radiating device.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
20. **He will have a knowledge of buffers, multipliers and power amplifiers.**	**a. A lesson on the steps necessary to increase frequency and power of a transmitter.**
21. **He will have an understanding of the types and methods of modulation.**	**a. Lesson on modulation to show types.** **b. A lesson on modulation to show methods for amplitude modulation.**
22. **He will have an understanding of receivers.**	**a. A lesson on receivers.** **1. Detectors.** **2. Amplifiers, tuning methods.** **3. The superhetrodyne principle.** **(Show a small ac-dc receiver to point out the various parts.)**
23. **He will have a knowledge of power supplies.**	**a. A lesson on power supplies as used to furnish the power for various types of electronic equipment.** **1. Battery packs.** **2. Alternating current source.** **a. ac-dc type** **b. transformer type** **c. filters** **d. voltage dividers** **e. regulation**
24. **He will have an understanding of wave propagation.**	**a. A lesson on wave propagation as it pertains to air.**
25. **He will have an understanding of antennas and transmission lines.**	**a. A lesson on antennas and transmission lines to teach their properties.** **b. Construct an antenna that can be used at home with transmission line of suitable type.** **NOTE: Be sure to caution about using arrestors for lightning protection.**

Objective: 4. **To develop in each pupil problem-solving abilities related to the materials, processes and products in communications.**

Expected pupil behavioral change	Suggested activities to implement the change
1. He will be able to identify the various insulating materials used in electrical work.	**a. Lesson on insulators used in electricity.**
	b. Make up a display board of materials locally available.
	c. Give a class demonstration on insulative materials.
2. He will be able to identify the various conductors commonly used in the electrical industry.	**a. Lesson on conductors used in electricity.**
	b. Construct for display purposes a display of materials locally available that are considered conductors and their value.
	c. Give a class demonstration on the conductivity of various materials.
3. He will have an understanding of how electricity is made and delivered.	**a. Take a field trip to a local generation plant if available.**
	b. Read Unit #26 in Ref. #4 or Unit #59 in Ref. #2.
	c. Construct as a group a miniature hydroelectric plant or steam generation plant.
	d. For notebook, make an accurate drawing of how power comes from it source to the lamp in the home.

Objective: 5. **To develop in each pupil a degree of skill in the safe use of tools and equipment used in communications.**

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use layout, cutting, forming, holding, fastening and assembly tools and procedures.	**a. Lessons over layout, cutting, forming, holding, fastening and assembly tools needed in building communication devices.** **b. Have pupil locate and name the layout, cutting, forming, holding, fastening and assembly tools he will use.**
2. He will recognize and use testing instruments and procedures.	**a. Lessons over testing instruments needed in building communication devices.** **b. Have pupil locate and name the testing instruments he will use.**
3. He will recognize and use equipment and procedures.	**a. Lessons over equipment needed in building communication devices.** **b. Have pupil demonstrate safe operation of equipment he will use.**
4. He will care for tools and equipment.	**a. Have pupil return tools and equipment to proper place as soon as he finishes with them.**
5. He will recognize quality and craftsmanship in the products of the communication equipment industry.	**a. Have pupil inspect various products for quality of workmanship.** **b. Have pupil refer to Consumer Report for products made by the industry.**

Approach:

1. Demonstrate to the class a radio-controlled car and inquire if they are interested in producing one.

2. Demonstrate to the class simple walkie-talkie units and explain their operating principles and construction.

3. Discuss ham radio stations and explain the possibility of setting one up in the school.

Activities:

1. Build a radio controlled unit.

2. Build a walkie-talkie unit.

Suggested Texts:

Brown, J. B., Gilbert, J. W. and Heffmeister. Instructors Manual for Teaching Electronics, I and II. Vol. I, McMinnville, Tennessee, Electromatic Manufacturing Co., Inc., 1962.

Buban, Peter, and Schmitt, Marshall L. Understanding Electricity and Electronics. New York, McGraw-Hill Book Company, Inc., 1962.

Gerbracht, Carl and Robinson, Franke. Understanding America's Industries. Bloomington, Ill., McKnight and McKnight Publishing Co., 1962.

Selected Publications of the American Radio Relay League, West Hartford, Conn.

1. The Radio Amateur's Handbook.
2. A Course in Radio Fundamentals.
3. The A. R. R. L. Antenna Book.
4. How to Become a Radio Amateur.

Resource Materials:

Department of the Army. Introduction to Electronics. Department of Technical Manuals TM 11-660. Washington, D. C.: U. S. Gov't. Printing Office.

Evans, Rupert N. and Charles B. Porter. Experimental Basic Electronics. Bloomington, Illinois: McKnight and McKnight Publishing Co.

Grob, Bernard. Basic Electronics. New York City: McGraw-Hill Book Co., Inc.

Grob, Bernard and Milton S. Kiver. Applied Electronics. New York City: McGraw-Hill Book Co., Inc.

Headquarters Staff of American Radio Relay League. The Radio Amateur's Handbook. West Hartford, Conn. Amateur Radio Relay League. (Published annually)

Resource Materials: (Continued)

Hickey, Henry V. and William M. Villines, Jr., Elements of Electronics. New York City: McGraw-Hill Book Co., Inc.

Gerrish, Howard H. Electricity. 1322 S. Wabash, Chicago 5. The Goodheart-Willcox Co., Inc.

Gerrish, Howard H. Electronics. 1322 S. Wabash, Chicago 5. The Goodheart-Willcox Co., Inc.

Marcus, Abraham and William Marcus. Elements of Radio. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Marcus, William and Alex Levy. Elements of Radio Servicing. New York City: McGraw-Hill Book Co., Inc.

Marcus, John. Television and Radio Repairing. New York City: McGraw-Hill Book Co., Inc.

Mandl, Matthew. Fundamentals of Electric and Electronic Circuits. Englewood Cliffs, N. J.: Prentice-Hall, Inc.

Oldfield, R. L. Radio - Television and Basic Electronics. Chicago: American Technical Society.

Editors and Engineers, Ltd. The Radio Handbook. Summerland, California: Editors and Engineers, Ltd.

Shrader, Robert L. Electronic Communication. New York City: McGraw-Hill Book Co., Inc.

Slurzberg, Morris and William Osterheld. Essentials of Electricity for Radio and Television. New York City: McGraw-Hill Book Co., Inc., 2nd Edition.

Slurzberg, Morris and William Osterheld. Essentials of Radio. New York City: McGraw-Hill Book Company, Inc.

Staff of Electron Tube Division, Radio Corporation of America. RCA Receiving Tube Manual, Technical Series RC-19 (for 1959) Harrison, New Jersey: Electron Tube Division, Radio Corporation of America, (New edition published annually).

Steinberg, William S. and Walter B. Ford. Electricity and Electronics. Chicago: American Technical Society.

Suffern, Maurice G. Basic Electrical and Electronic Principles. New York City: McGraw-Hill Book Company, Inc.

Van Valkenburgh, Nooger and Neville, Inc., Basic Electronics. New York City: John F. Rider Publisher, Inc.

Tools and Equipment:

Steel bar magnets; Steel horseshoe magnets; Alnico bar magnets; Alnico horseshoe magnets; Jar of iron filings; Iron tacks; Paper clips; String; 6" square white cardboard plates; Plates (4" square or larger) of glass, brass, plastic and iron; Hacksaw blades; Compass; Needles; Corks; Glass beaker; Hair comb; Bits of paper; Electroscope; Electromatic 60-31, 26, 39 or equal examples of conductors and insulators; D. C. Power Source or Electromatic 5-20; Rubber balloon; Wool cloth; Silk cloth; Plastic rod; Instruction panel 50-2; Compass; 1½ Volt dry cell; Leads; 12 volt, D.C. source; Nails; Magnet wire; Buzzer relay; Coil on Hollow core or electromatic 60-40; Electromatic instruction panel 50-3; Electromatic D. C. power supply 5-20; Electromatic Accessory lamp base 60-45; Electromatic rheostat 60-36; EM lamps in series 50-4 Panel; EM Lamps in Parallel 50-5 Panel; Lamps; Meters; Test leads; Power source; Dry cells; D. C. Voltmeter; Transformer; Magneto (D.C. Gen.); Vacuum tube volt meter; Strips of copper; Aluminum; Iron; Zinc or galv. iron; Carbon rod; Lemon; Nail; Wire; Charts of cells batteries or E. M. instruction chart 50-50; Volt OHM meter; Vacuum tube bolt meter; Galvanometer; Soldering gun; Diagonal pliers 4"; Long nose pliers 4"; Screw drivers 6", 4"; Volt Ohm - Milliamp meter; Vacuum tube voltmeter; A calibrated receiver (shortwave); AF/RF signal generator; Oscilloscope.

Materials and Supplies:

1. Radio controlled units.
2. Walkie-talkie units.
3. Assorted sizes and values of resistors, condensers, vacuum tubes and other radio parts that may be purchased from various suppliers.

Lessons to be Taught:

1. Magnets and magnetism.
2. The Electron Theory.
3. Ohms and Watts Laws.
4. Sources of current.
5. Circuitry and wiring diagrams.
6. Direct current testing instruments.
7. Transformers.
8. Standard color codes.
9. Introduction to electric and electronic communications.
10. Telephone communications.
11. Telegraph communications.
12. Public address and intercommunication systems.
13. Introduction to the electronics industry.
14. Resonant circuits.
15. Coupled circuits.
16. Linear circuits.
17. Vacuum tubes.
18. Amplification.
19. Multi-element tubes.
20. Signal wave production.
21. Buffers, multipliers, and power amplifiers.
22. Types and methods of modulation.
23. Receivers.
24. Power supplies.
25. Wave propagation.
26. Antennas and transmission lines.

Evaluation Techniques:

Instructors' observation of interest and response of pupils.
Evaluation of workmanship of individuals on project work.
Periodic use of quizzes and tests over material covered.
(true and false, completion and multiple choice or combination may be used)
Use the round robin technique for parts and circuit identification.

Example of Quiz:

Instructional quiz - Detectors

1. Four types of Detectors are:
(a)____________(b)____________(c)____________(d)____________

2. The operation of Detection is accomplished in three principal steps as follows:
(a)____________(b)____________(c)____________

3. The extraction of the audio frequency signal from a RF Modulated Wave is called ______________________________ or ______________________.

4. A Diode Detector is more nearly like ______________.
(1) a rectifier (2) an amplifier (3) a cathode ray tube.

5. Another name for Detection is?

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavioral changes listed in the analysis of the objectives have been accomplished.

Service Industries Grade 12

Title of Unit: Small Service Business Management

Introduction:

The United States is the richest country in the world; limitless opportunities to make money -- often a great deal of money -- exist through the tremendous buying power of millions of the richest and freest spending individuals on the face of the earth.

But there is a good deal more to making money than merely starting a business. Because a business does not exist by itself; it is a part of you, an extension of your own personality and aptitude. There are actually no successful businesses; there are only successful men. A man succeeds only when he chooses the right business -- one that is entirely suited to his personal temperament and talents. It is foolish and foolhardy to ignore these elements and select an enterprise merely because "there is money in it." But if, on the other hand, you choose a business because you are sure it is the right business for you, then you've already started yourself well on the road to success.

Scope:

a. 12th grade

b. 2 weeks (suggested)

c. 280 minutes per week (min.)

Objectives

1. To develop in each pupil an insight into and understanding of the problems of going into a small service business.
2. To develop in each pupil an understanding of the procedures used in starting a new small service business.
3. To develop in each pupil an understanding of the advantages and disadvantages of buying a going small service business.
4. To develop in each pupil an understanding of how small service businesses are managed.
5. To develop in each pupil an awareness of the laws and regulations that should be understood before starting a small service business.

Objective: 1. To develop in each pupil an insight into and understanding of the problems of going into a small service business.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know if he is the type of individual that should go into a small service business.	a. Discussion on "Am I the type to establish my own service business?". b. Assignment sheet - "Honestly rating yourself".
2. He will realize the problems in choosing and starting a small service business.	a. Discussion on "What business should I choose". b. Discussion on the following points: Your own background, other people's needs, and opportunities for growth when choosing a small service business.
3. He will understand the chances of success when a person goes into a small service business.	a. Discussion on small service business trends from 1900 to date.
4. He will understand the returns on investments when a person goes into a small service business.	a. Discussion on the rate of return on money invested in a small service business.

Objective: 2. **To develop in each pupil an understanding of the procedures used in starting a new small service business.**

Expected pupil behavioral change	Suggested activities to implement the change
1. He will realize how much capital will be needed when starting a new small service business.	a. Discussion - no figure can be specified, since amounts differ widely; depending upon kind of business, type of establishment, location and current price level.
2. He will understand from what sources monies can be obtained to start a new small service business.	a. Lesson on how money can be obtained to start a new small service business.
3. He will understand the advantages and disadvantages of sharing ownership with others.	a. Lesson on "What form of business organization" - Proprietorship, Partnership or Corporation?
4. He will know the procedures involved in picking a location for a new small service business.	a. Lessons on "The selection of the town or city" - "The choice of the area within the town or city" - "The selection of the specific site in a chosen area".

Objective: 3. **To develop in each pupil an understanding of the advantages and disadvantages of buying a going small service business.**

Expected pupil behavioral change	Suggested activities to implement the change
1. He will understand the advantages and disadvantages of buying a going small service business.	a. Discussion of these points when buying a going small service business. 1. profitability 2. tangible assets 3. intangibles 4. liabilities 5. legal advice

Objective: 4. **To develop in each pupil an understanding of how small service businesses are managed.**

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know about buying and pricing various items in a small service business.	a. Lesson on the buying and pricing of various items in a small service business.
2. He will realize the importance of selling in any business.	a. Lesson on the methods of selling in a small service business.
3. He will understand the problems involved in selecting and training personnel for a small service business.	a. Lesson on methods and techniques in selecting and training personnel for a small service business.
4. He will understand the importance of adequate record keeping in a small service business.	a. Lesson on how to keep proper records for a small service business.

Objective: 5. To develop in each pupil an awareness of the laws and regulations that should be understood before starting a small service business.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will realize the laws and regulations that must be understood before starting a small service business.	a. Lessons on licensing, regulations of trade practices and labor relations.
2. He will know about Federal, State and local taxes before starting a small service business.	a. Lesson on taxes that must be considered when starting a small service business.
3. He will understand the needs of insurance when starting a small service business.	a. Lesson on types of insurance to consider when starting a small service business.

Approach:

1. Take field trips to the following small service businesses.

    a. service station
    b. dry cleaning establishment
    c. small motel
    d. small restaurant
    e. appliance service shop

2. Selected motion pictures dealing with small business management.

3. Speaker on small business management.

Activities:

1. Have pupils organize a small service business as a group project.

Suggested Texts:

Educational Department. Your Opportunities in Management. New York 17, N. Y.: National Association of Manufacturers, 1954.

Metcalf, Wendall O. Starting and Managing a Small Business of Your Own. Washington, D. C.: Superintendent of Documents, U. S. Government Printing Office, 1962.

Small Business Administration. Starting and Managing a Service Station. Washington, D. C.: Superintendent of Documents, U. S. Government Printing Office, 1962.

Resource Material:

Send for bulletin No. SBA 115B entitled Small Business Administration Publications from the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402 for additional resource materials.

Title of Unit: Appliance Servicing (A study of a servicing industry)

Introduction:

The purpose of this unit is to give some practical information and knowledge in the repairs and servicing of electrically-operated home appliances which today constitute an ever-increasing capital investment in the average American household.

With the appearance on the market of a large number of fairly complex automatic or semi-automatic appliances, a proportionally greater amount of knowledge is required by the serviceman, dealer and pupil, in order to cope intelligently with the task at hand, which in each instance is not only to understand the construction and operation of an appliance, but also to troubleshoot and repair it when necessary with a minimum of effort and without resorting to time-consuming guess work.

With this information in mind, we hope to give the pupil a background and some technical knowledge in the field of appliance servicing.

Scope:

a. 12th grade

b. 7 - 11 weeks (suggested)

c. 280 min. per week (min.)

Objectives

1. To develop in each pupil an insight into and understanding of the appliance servicing business as a part of the household equipment industry and its place in our society.

2. To develop in each pupil an understanding of the job opportunities, requirements and working conditions in the appliance servicing business.

3. To develop in each pupil an understanding of the basic principles of electricity involved in servicing electrical appliances.

4. To develop in each pupil an understanding of the technical knowledges and procedures needed in solving problems related to the repair and maintenance of various types of appliances.

5. To develop in each pupil a degree of skill in the safe use of tools and equipment needed in servicing appliances.

Objective: 1. **To develop in each pupil an insight and understanding of the appliance servicing business as a part of the household equipment industry and its place in our society.**

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know the variety and sizes of various household equipment industries.	a. Show an exhibit of small appliances produced by various manufacturers.
	b. Lesson on the importance of the Household Equipment industry.
	c. Discussion on the various types of appliances produced by this industry.
2. He will realize the important role that the Household Equipment industry plays in our present society.	a. Discussion on the number of appliances now in the home compared with a mere sixteen in 1940.
	b. Discuss the inter-relationships which exist between the appliance servicing industry and the household equipment industries.
	c. Discussion on buying service when you purchase new appliances.
3. He will know how competition exists in the appliance and household equipment industry.	a. Discussion on qualitative differences (trade names) when appliances are identically priced.
	b. Lesson on the importance of eye appeal of the product to prospective buyers and consumers.
	c. Discussion of the so-called fair trade pricing as it applies to small appliances.

Objective: 2. To develop in each pupil an understanding of the job opportunities, requirements and working conditions in the appliance servicing business.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a knowledge of the variety of opportunities in the line and staff organization of a Household Equipment Industry. Suggested fields are: Sales Design Engineering Methods Engineering Tool Design Cost Accounting Materials Control Production Control Personnel Maintenance Quality Control Finance	a. Information sheets on the various job opportunities in the line and staff organization of a Household Equipment Industry. b. Discuss with the class the requirements for entering the various fields in a manufacturing line and staff organization. c. Invite speaker from a manufacturing concern that is involved in managerial duties. d. Assign readings in the Occupational Outlook Handbook.
2. He will have a knowledge of the variety of opportunities in the assembly plant of a household equipment industry. Suggested fields are: Administrative & Clerical Occupations Assembly Occupations Fabricating Occupations Testing & Inspection Maintenance Occupations	a. Bulletin board "Variety of occupations in an assembly plant of Household Equipment". b. Have pupil prepare a guidance folder covering the various assembly plant occupations in this industry.
3. He will have an understanding of the nature of work of an appliance serviceman.	a. Lesson on the educational, technical and personal qualifications needed to become an appliance serviceman. b. Discussion on where appliance serviceman are employed. c. Discussion on weekly earnings received by qualified appliance servicemen.

Objective: 2. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
4. He will understand the role of the union in the household equipment industry.	a. Discuss with pupil the United Electrical Workers Union. b. Discussion on the working conditions and wage rates in the Household Equipment Industry. c. Have pupil do research and present to class information concerning the two large companies producing appliances. 1. General Electric Co. 2. Westinghouse Electric Co.

Objective: 3. To develop in each pupil an understanding of the basic principles of electricity involved in servicing electrical appliances.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know how electric current is measured, computed and used.	a. Lesson on Ohm's Law.
	b. Lesson on how electricity flows along a conductor.
	c. Lesson on the electron theory.
2. He will know how voltage is produced, measured and controlled.	a. Lesson on what is voltage and how it is produced.
	b. Lesson on measuring voltage.
3. He will know how current flow is affected by resistance.	a. Lesson on resistance - what it does and how it is used.
	b. Lesson on measuring resistance.
	c. Review lesson on current, voltage and resistance.
4. He will know the conductors and insulators of electricity.	a. Review lesson on the flow of electricity along a conductor.
	b. Discussion on the carrying capacity of various sizes of wires.
	c. Lesson on the effect of wire length and size on resistance.
	d. Lesson on the effect of wire temperature on resistance and its effect on electric current.
	e. Lesson on the effect of wire temperature on expansion and its effect on electric current.
5. He will understand the operation of parallel, series and series-parallel circuits and where they are used.	a. Lesson on various types of circuits used in appliances.
	b. Demonstrate and show series,parallel and series-parallel circuits used in appliances.

Objective: 3. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
	c. Lessons on use of meters in checking these circuits.
6. He will know how electric energy is measured and computed.	a. Lesson on how to measure electrical energy. b. Lesson on watts, kilowatts and horsepower. c. Lesson on computing the cost of electrical energy.
7. He will know how electrical energy can be converted into mechanical energy.	a. Lesson on the theory and operation of the electric motor. b. Lesson on the purpose of the commutator, brushes and field circuit. c. Lesson on various types of electric motor circuits.

Objective: 4. To develop in each pupil an understanding of the technical knowledges and procedures needed in solving problems related to the repair and maintenance of various types of appliances.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will understand the operating principles of small heat-producing and motor-operated electrical appliances.	a. Give lessons on operating principles of small heat-producing electrical appliances and motor-operated electrical appliances.
	b. Have pupil prepare diagrams of the operating principles of various heat-producing and motor-operated electrical appliances. (Keep in notebook).
2. He will learn to read and interpret schematic and disassembled view drawings of small heat-producing and motor-operated electrical appliances.	a. Have pupil make schematic drawings of electrical appliances they will service.
	b. Lesson on reading and interpreting schematic and disassembled view drawings of small electrical appliances.
3. He will know the procedures used in troubleshooting small heat-producing electrical appliances.	a. Have pupil inspect small heat-producing electric appliance to determine the disassembly method.
	b. Have pupil check power cord and plug (broken wires, insulation, etc.) attached to appliance.
	c. Have pupil check switches in appliance (electrical and mechanical).
	d. Have pupil check for broken wires in appliance.
	e. Have pupil check for opens, shorts and grounded wires in appliance. (heating elements).
	f. Have pupil check the mechanical adjustment of the appliance.
	g. Have pupil check for mechanical defects in the appliance. (binding shafts, broken pieces, bent arms, etc.)

Objective: 4. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
4. He will know how to repair and service small heat-producing electrical appliances.	a. Have pupil disassemble the small heat-producing electrical appliance.
	b. Have pupil repair or replace necessary parts of the appliance being serviced.
	c. Have pupil assemble the repaired or serviced appliance.
	d. Have pupil test and check the serviced appliance.
5. He will know the procedures used in troubleshooting small motor-operated electrical appliances.	a. Have pupil inspect small motor-operated electric appliance to determine the disassembly method.
	b. Have pupil check power cord and plug (broken wires, insulation, etc.) attached to appliance.
	c. Have pupil check brushes and commutators in universal and D.C. motors of the appliance.
	d. Have pupil check switches in appliance. (electrical and mechanical).
	e. Have pupil check for broken wires in appliance. (field coil).
	f. Have pupil check for opens, shorts, and grounded wires in appliance.
	g. Have pupil check the mechanical adjustments of the appliance.
	h. Have pupil check for mechanical defects in the appliance. (binding shafts, bent arms, cords off pulleys, broken pieces, dry bearings, etc.).

Objective: 4. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. He will know how to repair and service small motor-operated appliances.	a. Have pupil disassemble the small motor-operated electrical appliance. b. Have pupil repair or replace necessary parts of the appliance being serviced. c. Have pupil assemble the repaired or serviced appliance. d. Have pupil test and check the serviced appliance.

Objective: 5. To develop in each pupil a degree of skill in the safe use of tools and equipment needed in servicing appliances.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use layout, cutting, forming, holding, fastening and assembly tools and procedures.	a. Lessons over layout, cutting, forming, holding, fastening, and assembly tools needed in servicing appliances.
	b. Have pupil locate and name the layout, cutting, forming, holding, fastening and assembly tools he will use.
2. He will recognize and use testing instruments and procedures.	a. Lessons over testing instruments needed in servicing appliances.
	b. Have pupil locate and name testing instruments he will use.
3. He will recognize and use equipment and procedures.	a. Lessons over equipment needed in servicing appliances.
	b. Have pupil demonstrate safe operation of equipment he will use.
4. He will care for tools and equipment.	a. Have pupil return tools and equipment to proper place as soon as they finish using them.
5. He will recognize quality and craftsmanship in the products of the Household Equipment Industry.	a. Have pupil inspect various appliances for quality of workmanship.
	b. Have pupil refer to Consumer Report for appliances made by the Household Equipment Industry.

Approach:

1. Visit some appliance service shop and have the appliance serviceman demonstrate some of the tests and repairs of modern home electrical appliances.

2. Have pupils bring in old appliances from home and repair them in the shop.

3. Have a discussion on the construction features, trade names and designs of common modern home electrical appliances.

4. Have class discussion on procedures used in troubleshooting common modern home electrical appliances.

Activities:

1. Develop with the pupils the principles of diagnosing, correcting and testing a modern home appliance. Stress the importance of following a logical sequence with servicing an appliance.

2. Have pupils diagnose, correct and test the following modern small home (resistance-heating) electric appliances.
   Suggested items:

   a. irons
   b. toasters
   c. waffle bakers
   d. coffee makers
   e. space heaters
   f. range
   g. hot plate
   h. broiler
   i. egg cooker
   j. hair dryer
   k. water heater
   l. corn popper
   m. trivet
   n. heating pad
   o. skillet
   p. bottle warmer

3. Have pupils diagnose, correct and test the following modern small home (motor-operated) electric appliances.
   Suggested items:

   a. food mixers
   b. fans and blowers
   c. vacuum cleaners
   d. garbage disposers
   e. air conditioners
   f. cellar drain pump
   g. razor
   h. coffee grinder
   i. can opener
   j. knife sharpener

4. Have pupils do research on operating principles of the various modern home appliances.

5. Have pupils complete cost sheets and repair orders on all home appliances they service.

Suggested Texts:

Anderson, Edwin P. *Audels Home Appliance Service Guide*. New York: Theodore Audel & Co., 1961.

Campbell, Edward A. *How to Repair Home Appliances*. New York: Arco Publishing Co., Inc., 1962.

Crouse, William H. *Home Appliance Fix-It Manual*. New York: McGraw-Hill Book Co., 1962.

Stieri, Emanuele. *Electricity in the Home*. New York: Barnes & Noble, Inc., 1960.

Resource Materials:

Crouse, William H. Electrical Appliance Servicing. New York, N.Y.: McGraw-Hill Book Co., Inc., 1950.

Gabbert, William L. Electrical Appliance Service Manual. New York: Holt, Rinehart and Winston, Inc., 1961.

Graham, Kennard C. Small Commutator Motors. Chicago, Ill.: American Technical Society, 1952.

Graham, Kennard C. Understanding and Servicing Fractional Horsepower Motors. Chicago: American Technical Society, 1961.

Make Your Own Electrical Repairs. Greenwich, Conn.: Fawcett Publications, 1963.

Toaster Service and Repair. 5944 N. Newark Avenue, Chicago: Advance Trades, 1953.

Tools and Equipment: (Partial List)

Milliammeter, voltmeter, ammeter, wattmeter, bell-ringer test set, series test lamp, hot circuit tester, appliance test board for electrical resistance-heating appliances, combination pliers, diagonal cutting pliers, needle-nose pliers, round nose pliers, side cutting pliers, various sizes of Phillip screwdrivers, various sizes of standard blade screwdrivers, tin snips, various sizes of adjustable wrenches, screwplates-N.C. & N.F., electric soldering gun.

Materials and Supplies: (Partial List)

Various sizes of heating elements for different appliances, assortment of machine screws, bushings, solder, soldering lugs, switches for various appliances, rubber & friction tape, various sizes and types of wire.

Lessons to be Taught:

Manipulative Lessons

This list of lessons was taken from the analysis of objectives and includes those lessons which enable the student to carry on the activities suggested by the unit.

1. Read a schematic drawing of an electric appliance.
2. Procedures used in troubleshooting small heat-producing and motor operated electrical appliances.
3. Procedures used in repairing and servicing heat-producing and motor-operated electrical appliances.
4. Testing and checking out repaired appliances.
5. Layout, cutting, forming, holding and assembly tools and procedures.
    a. Recognize and select
    b. Name correctly
    c. Use properly and safely (To extent needed in servicing an appliance).

Lessons to be Taught: (Continued)

Manipulative Lessons (Continued)

6. Testing instruments and procedures.
    a. Recognize and select.
    b. Name correctly
    c. Use properly and safely (To extent needed in servicing an appliance).

7. Machine and procedures.
    a. Recognize and select
    b. Name correctly
    c. Use properly and safely (To extent needed in servicing an appliance).

Related Lessons

This list of lessons was taken from the analysis of objectives and is in the nature of general statements of information to be taught rather than specific titles. It should be noted that this does not include films, discussions, and other teaching methods suggested to achieve the behavior changes.

1. The importance of the Household Equipment Industry in our society.
2. The importance of eye appeal of products to prospective buyers and consumers.
3. Educational, technical and personal qualifications needed to become an appliance serviceman.
4. Ohm's Law.
5. How electricity flows along a conductor.
6. Electron theory.
7. What is voltage and how it is produced.
8. Measuring voltage.
9. Resistance - what it does and how it is used.
10. Measuring resistance.
11. Effect of wire length and size on resistance.
12. Effect of wire temperature on resistance and its effect on electric current.
13. Effect of wire temperature on expansion and its effect on electric current.
14. Using meters.
15. Measuring electrical energy.
16. Computing cost of electrical energy.
17. Theory and operation of the electric motor.
18. Purpose of the commutator, brushes and field circuit.
19. Various types of electric motor circuits.
20. Operating principles of small heat-producing electrical appliances and motor-operated electrical appliances.
21. Reading and interpreting schematic and disassembled view drawings.

Teaching Aids and Devices:

1. Cut-a-ways of internal units of various appliances.
2. Charts on principles of the following appliances: irons, toasters, waffle bakers, coffee makers, space heaters, hot plate, broiler, egg cooker, hair dryer, water heater, corn popper, trivet, heating pad, skillet, bottle warmer, food mixer, fans and blowers, vacuum cleaner, garbage disposer, air conditioner, razor, coffee grinder, can opener, knife sharpener.

Teaching Aids and Devices: (Continued)

3. Mock-ups of various appliances.
4. Flash cards on appliance serviceman's tools and testing instruments.
5. Overhead frames on troubleshooting various appliances.
6. Stencils on how to troubleshoot small electric appliances.

Evaluation Techniques:

During the period of time which this unit will encompass, occasional tests and quizzes will be given. They will include the various techniques and methods listed below:

Techniques:
1. Performance tests
2. Completion questions
3. Multiple choice questions
4. Recall items
5. Tool identification tests
6. Self-evaluation sheets
7. Teacher observation

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavioral changes listed in the analysis of the objectives have been accomplished.

Title of Unit: Automotive Servicing (A study of a servicing industry)

Introduction:

Today transportation supplies the people of this country with a means of carrying their goods to market, makes products available from all parts of the country, and provides the necessary transportation for recreation and relaxation. From this view point, it is easy to see the great need for a knowledge of the automotive service industry. This industry is rapidly growing with the ever increasing number of automotive vehicles. It provides employment for a large number of individuals and affects the daily lives of all who live in this society.

Scope:

a. 12th grade

b. 6 - 9 weeks (suggested)

c. 280 minutes per week (min.)

Objectives

1. To develop in each pupil an insight into and understanding of the automotive service industry and its place in our society.

2. To discover and develop pupil interests and talents in the automotive servicing industry.

3. To develop in each pupil an understanding of the technical knowledges and operating principles needed in solving problems related to repairing and performing maintenance on automobiles.

4. To develop in each pupil a degree of skill in the safe use of tools and equipment needed in servicing automobiles.

Objective: **1. To develop in each pupil an insight into and understanding of the automotive service industry and its place in our society.**

Expected pupil behavioral change	Suggested activities to implement the change
1. He will be familiar with the organization of the automotive service industry, and relate the personnel organization of the industrial arts shop to similar situations in industry.	a. A discussion lesson on the organization and function of the service industry. b. Develop a personnel organization that may be used successfully in the automotive service program. c. If possible visit a local garage and talk with personnel about duties and responsibilities.
2. He will read professional articles concerning automotive servicing and related automotive areas.	a. Assign selected readings from textbook, magazines and other articles. b. Have reports given over reading assignments. c. Discuss reports and bring out important points. Stress the importance of industry in our way of life. d. Encourage pupil to bring in articles on related topics.
3. He will visit automotive service industries when possible to learn about methods and materials, etc.	a. Plan organized visit to a local automotive service industry. b. During demonstrations point out difference and similarities of industry and the school shop. c. Use motion pictures to supplement field trips. d. Encourage pupil to make own trips and report to the class.

Objective: 1. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
4. He will recognize various raw materials and finished parts and talk about their sources, transportation and handling.	a. Exhibit various materials and parts and talk about them with the class.
	b. Use motion pictures to show how materials and parts are developed, transported and used.
	c. Assign reports on various raw materials used in automobile manufacture.
	d. Use specification manuals in the selection and use of parts.
5. He will seek information concerning new developments and trends in the automotive industry.	a. Have pupil make a bulletin board display.
	b. Use shop displays to stimulate interest in new developments.
	c. Encourage pupil to bring in clippings about new ideas and trends.

Objective: 2. To discover and develop pupil interests and talents in the automotive servicing industry.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will have a knowledge of the variety of occupational opportunities in the automotive servicing industry. Suggested fields are: Automotive mechanic Specialty mechanic Shop foreman Service manager Salesman Sales manager Parts manager Jobber Salesman Technical teacher Driver of truck or bus Insurance adjustor Owner of service station Automobile dealer	a. Information sheets on various automotive servicing occupations.
	b. Assignment sheet - explore an occupation of pupil's choice in automotive servicing industry.
	c. Invite speaker from an automotive servicing station in the area.
	d. Show occupational films on automotive servicing and discuss the educational requirements for the worker.
	e. Discussion on the relationship of occupations to the experiences to be gained in the laboratory.
2. He will have a knowledge of requirements and occupational choice factors to consider in selecting an occupation.	a. Have the pupil make a list of personal qualities desired of a worker in the automotive service industry and discuss the same.
	b. Assign readings on the automotive servicing industry in guidance bulletins, automobile company reports, etc.
3. He will be aware of the working conditions and realize the role unions play in the automotive servicing industry.	a. Have pupil investigate and discuss the unions involved in the automotive servicing industry.
	b. Have pupil compare the local working conditions with those in our larger cities.
	c. Discuss the working conditions in a small automotive repair shop compared with a large automotive servicing center.

Objective: 3. To develop in each pupil an understanding of the technical knowledge and operating principles needed in solving problems related to repairing and performing maintenance on automobiles.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know and understand the operating principles of the automobile.	a. Lessons on the purpose and function of the following: 1. Automobile engine a. fuel system b. ignition system c. lubrication system d. cooling system e. electrical system 2. Power train 3. Framework 4. Steering & suspension system 5. Brake system b. Information sheets on the following: 1. Automobile engine 2. Power train 3. Framework 4. Steering and suspension system 5. Brake system c. Reading assignments on the operating principles of the automobile. d. Obtain and show motion pictures on the automobile engine, power train, framework, steering and suspension system and the brake system.

Objective: 3. (Cont.)

Expected pupil behavioral change	Suggested activities to implement the change
2. He will know the proper procedures in servicing which includes diagnosing, correcting and testing.	a. Lesson on - proper procedures to use when servicing an automobile.
	b. Visit a garage and have shop foreman explain and demonstrate servicing procedures used by the company.
	c. Lesson on - preventative maintenance and proper servicing of automobiles.
3. He will be able to use the automotive specification manuals and charts.	a. Consult manuals for proper service procedure.
	b. Consult manuals to determine proper engine specification data.
	c. Use a Lubrication Chart in lubricating automobiles.
4. He will know how to perform service operations on the automobile.	a. Clean, test and charge a battery.
	b. Clean and flush the cooling system, check thermostat.
	c. Change oil.
	d. Clean and check spark plugs.
	e. Replace points and condenser.
	f. Check or replace a fan belt.
	g. Change a tire.
	h. Perform proper lubrication procedure.
	i. Check master cylinder.
	j. Change air filter, oil filter and fuel filter.
	k. Wash and polish automobile and clean interior.

Objective: 3. (Cont.)

Expected pupil behavioral change	Suggested activities to implement the change
4. (Cont.)	l. Change wiper blade.
	m. Inspect and replace lighting devices.
	n. Check exhaust system.
	o. Check condition of brakes.
5. He will be able to make repairs on the automobile.	a. Have pupil diagnose, correct and test the following components of the automobile. 1. Automobile engine a. fuel system b. ignition system c. lubrication system d. cooling system e. electrical system 2. Power train 3. Frame work 4. Steering & suspension system 5. Brake system
6. He will be able to troubleshoot and test the various systems within the automobile.	a. Have pupil troubleshoot and test the following components of the automobile. 1. electrical system 2. fuel system 3. cooling system 4. lubrication system 5. power train 6. Brake system 7. Steering and suspension system

Objective: 4. To develop in each pupil a degree of skill in the safe use of tools and equipment needed in servicing automobiles.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use cutting, holding, measuring, pounding and assembly tools and procedures.	a. Lessons over those cutting, holding, measuring, pounding and assembly tools needed in servicing the automobile. b. Have pupil locate and name the cutting, holding, measuring, pounding and assembly tools he will use.
2. He will recognize and use servicing machines and procedures.	a. Lessons over those machines needed in the servicing of the automobile. b. Have pupil demonstrate the safe operation of machines he will use.
3. He will recognize and use testing instruments and procedures.	a. Lessons over those testing instruments needed in the servicing of the automobile. b. Have pupil locate, name and explain operations of the testing instruments he will use.
4. He will become more aware of the safety programs carried on in the automotive servicing center.	a. Have the shop foreman of an automotive servicing center lecture on the importance of safety in service work. b. Show movie on "industrial safety".
5. He will know how to care for tools, machines and testing instruments.	a. Have pupil clean and replace tools, machines and testing instruments to proper place after use.
6. He will employ safe work habits while working on the automobile and in the shop.	a. Plan procedure carefully before proceeding with job. b. Use proper tools to do the job. c. Follow procedure outlined for the job. d. Safety posters and charts.

Objective: 4. (Continued)

Expected pupil behavioral change	Suggested activities to implement the change
6. (Continued)	e. Active participation in student personnel organization.
	f. Follow rules regarding safe conduct at all times.
	g. Class lecture on location and use of fire equipment.
7. He will cooperate with instructor and other pupils.	a. Active participation in shop personnel organization.
	b. Participate in class discussion.
	c. Plan and carry through work with other students.
	d. Cooperate with instructor.

Suggested Approach:

1. Field trip to local service station or garage.
2. A trip through the automotive laboratory; point out tools and equipment and give a brief summary of use.
3. Selected motion pictures dealing with the automotive servicing.
4. Lecture of explain the importance of the automotive service industry as a possible vocation.

Activities:

The principal activity through which the objectives of this unit will be achieved will consist of study and work with components of the automobile. Emphasis will be on:remove and install, disassemble, repair and reassemble, of the following components:

Suggested:

- Piston engine
  - compression system
  - valve system
  - ignition system
  - fuel system
  - lubrication system
  - cooling system
  - governors
  - cranking system
- Clutch
- Drive Shaft, universal joints and rear axles
- Suspension
  - springs
  - shocks
  - wheels
  - tires
- Steering
  - spindles
  - linkage
  - gear
  - column
  - wheels
  - ball joint
  - power steering
- Brakes
  - mechanical
  - parking
  - hydraulic
  - power
- Electrical
  - generator
  - alternator
  - starter
  - regulator
  - motors
  - switches
  - lights
  - wiring
  - fuses
  - circuit breakers
- Instruments and Accessories
  - Radio
  - Clock
  - Speedometer
  - Gauges
  - Controls
  - Heater
  - Air Conditioning
- Frames and/or bodies
- Sheet metal repair
- Glass

Suggested Texts:

Crouse, William. Automotive Mechanics. New York: McGraw-Hill Book Co., 1956.

Glenn, Harold T. Automechanics. Peoria: Chas. A. Bennett Co., 1962.

Stockel, Martin W. Auto Mechanics Fundamentals. Homewood: Goodheart-Willcox Co., 1963.

Resource Materials:

Atteberry, Pat H. Power Mechanics. Chicago: The Goodheart-Willcox Co., 1961.

Frazee, Irving and Spicer, Edward. Automotive Collision Work. Chicago: American Technical Society, 1955.

Kuns, Ray F. Automotive Essentials. Milwaukee: Bruce Publishing Co., 1962.

Purvis, Jud. Fix Your Volkswagon. Homewood: The Goodheart-Willcox Co., 1963.

Stephenson, George E., Power Mechanics. Albany: Delmar Publishers, Inc., 1963.

Toboldt, William and Purvis, Jud. Motor Services Enclyclopedia. Chicago: The Goodheart-Willcox Co., Inc., 1962

Toboldt, William. Fix Your Ford V8's to 6's 1963 to 1954. Homewood: The Goodheart-Willcox Co., Inc., 1963

Toboldt, William. Fix Your Plymouth, All Models, 1963 to 1952. Homewood: The Goodheart-Willcox Co., 1963.

Toboldt, William. Fix Your Chevrolet, All Models 1963 to 1954. Homewood: The Goodheart-Willcox Co., Inc., 1963.

Venk, Ernest and Spicer, Edward. Automotive Maintenance and Trouble Shooting. American Technical Society, 1963.

Venk, Ernest and Spicer, Edward. Automotive Fuel and Ignition Systems. Chicago: American Technical Society, 1953.

Resource Materials: (Cont.)

Booklets

Why Preventative Maintenance Power Primer ABC's of Hand Tools Better Ignition Heavy Duty Generator Rochester Carburetor Starting and Generating Systems	Educational Relations Section Dept. of Public Relation General Motors Corp. Detroit 2, Michigan
ABC of Hydraulic Brakes Inside Story of Engine Oiling Story of Combustion	Chrysler Corporation Department of Public Relations P. O. Box 1919 Detroit 31, Michigan

Resource Materials: (Cont.)

Electric Service Storage Battery	Delco - Remy Division General Motors Corporation Anderson, Indiana
The Storage Battery - Its Fundamentals Use and Maintenance	The Electric Storage Battery Co. P. O. Box 8109 Philadelphia 2, Penn.
Ignition Circuit Spark Plug Manual Fundamentals - Electricity & Magnetism Starting Circuit	The Electric Autolite Co. Toledo 1, Ohio

Tools and Equipment: (Suggested partial list)

6" inside calipers, 6" outside calipers, cape chisel, cold chisel, diamond point chisel, machine screw tap and die set, tap and die set NF ¼" to 1", tap and die set NC ¼" to 1", 6" dividers, ball peen hammer, sledge hammer, adjustable locking pliers, long nose pliers, combination slip joint pliers, diagnonal cutter pliers, adjustable offset pliers, drive pin punch, center punch, hand hack saw, regular screw driver, phillips head screw driver, clutch head screw driver, screw extractor, scriber, tin snips, electric soldering copper and gun, combination square, steel stamps, 25' flexible tape, set of box wrenches, set of deep socket wrenches, wrench drive adapters, electrical wrenches, wrench handles, set of open wrenches, set of socket wrenches, set of tappet adjusting wrenches, torque wrenches, universal joint wrench, universal socket wrench, air compressor, aligning jig, arbor press, battery equipment, brake equipment, cleaning equipment, various containers, cord extension light, fender covers, creepers, electric portable drills, drill stands, drill press, engine lifting equipment, flaring tool kit, various gauges, bench grinder, growler, hoist, hones, impact wrench, jacks, metal bench type lathe, lift, lubrication equipment, various magnets, ammeter, voltmeter, micrometer, oil stone, oil measure, oiler, piston ring tool, special pliers - snap ring, hose clamp, brake spring,wheel pullers, radiator hydrometer, reamers, various auto. stands, spring tension scales, bench vise, welding equipment, coil tester, condenser tester, distributor tester, motor analyzer tester, power timing light, generator regulator tester, battery-starter tester, oscilloscope, generator-regulator test bench, spark plug cleaner and tester, headlight tester, thermostat tester, tool set for carburetors, tire service unit, valve reconditioning equipment, wheel alignment equipment, wheel balancing equipment, brake assembly, various carburetors, distributors, various engines, various fuel pumps, generators, ignition coils, ignition condensers, regulators, starting motors, steering gear assemblies, transmission assemblies,

Materials and Supplies: (Suggested partial list)

air hoses, batteries, battery bolts, battery clips, battery compound, hacksaw blades, auto lamp bulbs, extension cables, cable terminals, cleaning compound, test lead clips, various assortment of cotter pins, crocus cloth, set of drills, emery cloth, file cards, various assortment of files, automobile fuses, gasoline, gauge stock, grinding compound, grinding wheels, utility hose, hose clamps, hydraulic brake fluid, hydrometer floats, insulators, lubricants, assorted size of machine screw hex nuts, assorted sizes of semi-finished hex nuts, assorted sizes of semi-finished hex, castellated nuts, oil, paint, auto drain pans, electrical utility plugs, wiping rags, salammoniac, sandpaper, assorted sizes of machine round head screws, assorted sizes of cap hex, screws, shellac, solder, spark plugs, staples, rubber tape, friction

Materials and Supplies: (Continued)

tape, plastic tape, tire repair kits, thermometer, assorted sizes of tubing fittings, assorted sizes of tubing, assorted sizes of flat washers, assorted sizes of lock washers, assorted sizes of No. 18 to 24 copper wire.

Lessons to be Taught:

Manipulative lessons

This list of lessons was taken from the analysis of objectives and is listed in the nature of general statements of work to be taught rather than in specific titles.

Fundamentals of the Engine:

1. How to troubleshoot gasket leaks.
2. How to replace a head gasket.
3. How to replace a manifold gasket.

Cooling System:

4. How to replace a fan belt.
5. How to clean and flush a radiator.
6. How to repair a water pump.
7. How to replace a thermostat.

Lubrication System:

8. How to troubleshoot the lubricating system.
9. How to change the oil.
10. How to replace an oil pan gasket.
11. How to replace an oil filter.
12. How to repair an oil pump.

Valve Mechanisms:

13. How to grind a valve.
14. How to remove and replace valves.
15. How to troubleshoot the valve mechanism.

Piston, Crankshaft, and Connecting Rod Assembly:

16. How to read a micrometer caliper.
17. How to remove, clean and inspect the connecting rod assembly.
18. How to replace rings.
19. How to align the connecting rod.
20. How to install main bearings.
21. How to install connecting rod bearing inserts.

Fuel System:

22. How to troubleshoot the fuel system.
23. How to remove and replace a fuel pump.
24. How to disassemble, clean and assemble a carburetor.
25. How to care for the air cleaner.

Lessons to be Taught: (Continued)

Manipulative lessons (Continued)

Electrical System:

26. How to troubleshoot the electrical system.
27. How to test a storage battery.
28. How to install a battery.
29. How to charge a battery.
30. How to replace a head lamp.
31. How to replace light bulbs.
32. How to adjust a vibrating form.
33. How to install a headlight switch.
34. How to test for an open or short circuit.

Starting Motors and Generators:

35. How to troubleshoot the starting system.
36. How to undercut an armature.
37. How to test a starter or generator.
38. How to adjust a regulator.
39. How to repair a starter or generator.

Ignition System:

40. How to troubleshoot the ignition system.
41. How to clean and adjust spark plugs.
42. How to test a coil and condenser.
43. How to clean and adjust ignition points.
44. How to adjust cam dwell.
45. How to time an engine.
46. How to test the engine for a miss.
47. How to use the spark plug scope.
48. How to use the syncrograph.
49. How to use the scope analyzer.

The Clutch:

50. How to adjust a clutch pedal.
51. How to rebuild a clutch.

Transmission:

52. How to check the transmission for leaks.

Drive Mechanisms:

53. How to rebuild a universal.
54. How to remove and replace a universal.
55. How to replace axle bearings.
56. How to repair a differential.

Lessons to be Taught: (Continued)

Manipulative lessons (Continued)

Front axle and steering:

57. How to measure and adjust toe-in.
58. How to balance a wheel.
59. How to test and correct front end alignment.

Frame and Wheel Suspension:

60. How to rebuild shock absorbers.

Wheels and Tires:

61. How to lubricate and adjust a front wheel bearing.
62. How to mount a tire.
63. How to repair a tube-type tire.
64. How to repair a tubeless tire.

Brakes:

65. How to adjust brakes.
66. How to rebuild a master cylinder.
67. How to bleed brakes.

Safety:

68. How to properly jack up a car.

69. Lessons on those hand and machine tools and testing instruments as needed to complete the activity.

    a. Cutting tools
    b. Holding tools
    c. Measuring tools
    d. Pounding tools
    e. Assembly tools
    f. Machines used in service work
    g. diagnosing instruments

Related Lessons

This list of lessons was taken from the analysis of objectives and is listed in the nature of general statements of work to be taught rather than in specific titles.

It should be noted that this list does not include films, discussions, and other teaching methods suggested to achieve the behavior changes.

1. Organization of an industry.
2. Function of the automotive service industry.
3. Importance of industries on our economy.
4. Vocational opportunities.
5. New trends and developments.

Lessons to be Taught: (Continued)

Related lessons (Continued)

6. Fundamentals of the internal combustion engine.
7. How the cooling system works.
8. How the lubricating system works.
9. Winterizing an automobile.
10. Development of engine lubricants.
11. Types of oil, quality, additives, etc.
12. Valve mechanisms and how they work.
13. Importance of valve timing.
14. The fuel system and how it works.
15. Carburetors, fuel injection, super charges.
16. Magnetism.
17. Storage Battery.
18. Electrical circuits.
19. Electromagnetism.
20. Solenoids and relays.
21. Ohm's Law.
22. Measurement of electricity.
23. Mutual and self induction.
24. Electromagnetism.
25. Automobile electrical accessories.
26. Automotive electrical indicators.
27. Starters and generators.
28. Voltage regulators.
29. Principles of the ignition system.
30. The ignition coil.
31. Automatic advance mechanisms.
32. Principles of the clutch.
33. Types of transmissions.
34. Torque converters.
35. Drive mechanism - Theory of operation.
36. Front-end geometry.
37. Frame and body construction.
38. Wheel suspension systems.
39. Trends in tire construction.
40. Principles of the brake system.
41. Power brakes.
42. Safety in the use of hand tools.
43. General shop safety.
44. Personnel safety.
45. General safety practices.
46. Fire prevention while working on a car.
47. Safety in electrical work.
48. Carbon monoxide poisoning.

Teaching Aids and/or Devices:

Charts

Cooling System Chart		Union Carbide Consumer Products Co. 30E 42nd St. New York, N. Y.
Storage Battery Chart		The Electric Storage Battery Co. P. O. Box 8109 Philadelphia, Penn.
Bulletin Board Kits & Charts		Automobile Manufacturers Assoc.
Brake Adjustment Chart		American Brake Shoe Co. American Brakeblok Division 4600 Merritt Ave. 1 Detroit, Michigan
Starrett Decimal Equivalent Chart Starrett Micrometer Chart Starrett Tap and Drill Chart		Lis. Starrett Co. Athol, Massachusetts
Boxocket Wall Chart	SS-45-G	Snap-On Tools Corporation Kenosha, Wisconsin
Puller Wall Chart	SS-67-L	
Punch & Chisel Chart	SS-94-L	
Screwdriver Wall Chart	SS-133-L	
Socket Wall Chart	SS-24-AL	
Delco-Remy Training Charts Automobile Ignition System The Automobile Fuel System Rochester Carburetors		Educational Relations Section Department of Public Relations General Motors Detroit, Michigan

Mock-ups

Many mock-ups can be obtained from various parts dealers.

Cutaways

Transmissions, steering assemblies, clutches, carburetors, engines, differentials, fuel pumps, thermostats, water pumps, brake systems, etc.

Parts for Student Use

Carburetors, fuel pumps, regulators, relays, starters, generators, etc.

Films

ABC's of Hand Tools	13 min.	General Motors
ABC's of Internal Combustion	13 min.	General Motors
ABC's of Automobile Engine	21 min.	General Motors
ABC's of Diesel Engine	20 min.	General Motors
Basic Principles of Lubrication	15 min.	General Motors
Where Mileage Begins	13 min.	General Motors
Your Safety First	13 min.	General Motors
Safe As You Think	15 min.	General Motors

Teaching Aids and/or Devices: (Continued)

Films (Continued)

The Story of the Modern Storage Battery	30 min.	Willard Storage Battery Division P. O. Box 6266 Cleveland 1, Ohio

Film Strips

The following may be purchased from:

McGraw-Hill Book Co.
330 West 42nd St.
New York, New York

Automotive Mechanic Series Set #1
8 filmstrips $43.50

Automotive Mechanics Series Set #2
7 filmstrips $37.50

Jam Handy Organization
2821 East Grand Boulevard
Detroit, Michigan

The Automobile - How it works	5 sets
Automotive Care and Repair	5 sets
Electricity (Basic)	1 set
Hand Tools	1 set

Evaluation Techniques:

1. Observation of student while he is doing practical work in automobile servicing.
2. Written examination.
3. Oral and written reports on outside assignments.
4. Performance test in the area of troubleshooting the ignition system.

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavior changes listed in the analysis of the objectives have been accomplished.

Title of Unit: Repair and Refinishing Industries (a study of a servicing industry)

Introduction:

Wood finishing and upholstering has long been an important part of the furniture-manufacturing industry and has its place in the woods industries program; so many times it adds that finishing touch and appearance that makes the difference between a good and a poor product. With the many new tools and materials available in these occupations we should challenge our pupil in this area of work and give him these rewarding experiences. This unit will give the pupil an understanding of wood finishing and upholstering and its relationship to the furniture-manufacturing industry.

Scope:

a. 12th grade

b. 3 - 5 weeks

c. 280 minutes per week (min.)

Objectives

1. To develop in each pupil an insight into and understanding of the repairing and refinishing industries and their place in our society.
2. To acquaint pupils with the occupational opportunities available in the repairing and refinishing industries.
3. To develop in each pupil problem-solving abilities related to the materials, processes, and products of the repairing and refinishing industries.
4. To develop in each pupil a degree of skill in the safe use of tools and equipment needed in repairing and refinishing furniture.

Objective: 1. To develop in each pupil an insight into and understanding of the repairing and refinishing industries and their place in our society.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will know the industries involved in repairing and refinishing furniture.	a. Have pupil investigate the industries involved with repairing and refinishing furniture. b. Show slides of samples of products repaired and refinished by these industries. c. Have pupil discuss these products for **laboratory activities.**
2. He will realize the place this industry plays in our society.	a. Discuss with pupil reasons for saving money by having furniture refinished or upholstered rather than purchasing new. b. Discussion on value of restoring furniture - (antiques, etc.)
3. He will visit repairing and refinishing industries when possible to learn about methods and materials, etc.	a. Plan organized visit to a local repairing and refinishing industry. b. During demonstrations point out difference and similarities of industry and the school shop.

Objective: 2. To acquaint pupils with the occupational opportunities available in the repairing and refinishing industries.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will understand the nature of work and responsibility of a position of his choice in the repairing and refinishing industries.	a. Choose a position in a repairing and refinishing industry and write a report on work the position entails.
2. He will have an understanding of requirements and considerations applicable to occupational opportunities in the repairing and refinishing industries.	a. Explanation by school guidance counselor on factors to consider in occupational placement in the industries.

Objective: 3. To develop in each pupil problem-solving abilities related to the materials, processes, and products of the repairing and refinishing industries.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will analyze article for materials needed.	a. Have pupil complete a materials list. b. Discuss with pupil the various materials used in refinishing and upholstering furniture.
2. He will analyze article for methods of refinishing and upholstering.	a. Have pupil complete a plan of procedure for the article. b. Discuss with pupil procedures of furniture repair 1. Repair 2. Upholstery 3. Finish removal 4. Refinishing
3. He will recognize and obtain materials needed.	a. Show and discuss materials available. b. Show location of materials in shop and catalogs.
4. He will select and use refinishing and upholstery materials and techniques.	a. Demonstrate methods of refinishing and upholstering a piece of furniture. b. Discuss types of finishes and upholstery materials, their advantages and Industrial application c. Have pupil experiment with various finishes and upholstery materials to determine what would be best for his article. d. Have pupil refinish or upholster a piece of furniture.

Objective: 3 (continued)

Expected pupil behavioral change	Suggested activities to implement the change
5. He will inspect his article for quality in workmanship.	a. Have pupil inspect his refinished or upholstered article. b. Discuss industrial and school quality standards.

Objective: 4. To develop in each pupil a degree of skill in the safe use of tools and equipment needed in repairing and refinishing furniture.

Expected pupil behavioral change	Suggested activities to implement the change
1. He will recognize and use cutting, holding, measuring, pounding and assembly tools and procedures.	a. Lessons over those cutting, holding, measuring, pounding and assembly tools needed in repairing and refinishing furniture.
	b. Have pupil locate and name the cutting, holding, measuring, pounding and assembly tools he will use.
2. He will select and use machines and procedures.	a. Lessons over machines needed in repairing and refinishing furniture.
	b. Have pupil demonstrate safe operation of machines he will use.
3. He will care for tools, equipment and facilities.	a. Have pupil return tools to proper panels as soon as he finishes using them.
	b. Show pupil maintenance procedures on tools and equipment used.

Suggested approach:

1. Field trip to local wood finishing and upholstering shop.
2. The instructor will demonstrate how wood finishing and upholstery can decorate and make a product attractive.
3. Display of the new materials available for use in refinishing and upholstering furniture.

Activities:

1. Have pupils refinish or upholster a piece of furniture.
2. Have pupils complete a materials list. Use procedures common to industry. Show materials catalogs and how suppliers list their products.
3. Develop with pupils logical sequence in refinishing or upholstering a piece of furniture.
4. Have pupils refinish or upholster article according to logical sequence (plan) developed.

Suggested Texts:

Bast, Herbert. Essentials of Upholstery. Milwaukee, Wis.: Bruce Publishing Co., 1964

Jeffery, Harry R. Wood Finishing. Peoria, Ill.: Chas. A. Bennett Co., Inc., 1957.

Solderberg, George. Finishing Materials and Methods. Bloomington, Ill.: McKnight & McKnight Publishing Co., 1952.

Resource Materials:

Bast, Herbert. Making Upholstered Furniture. Milwaukee, Wis.: Bruce Pub. Co., 1951.

Bergen, ________. All About Upholstering. New York, N.Y.: D. Van Nostrand Publishing Co., 1941.

Solderberg, George. Restoring and Maintaining Finishes. Milwaukee, Wis.: Bruce Publishing Co., 1958.

Tools and equipment: (Suggested partial list)

7 oz. tack hammers, light round point 2½ in. circumference curved needle, 8 in. double round point needles, stretching pliers, 6, 8 and 10 in. regulators, ripping tool, 10 in. pinking shears, 10 in. bent trimming shears, skewers, 18 in. stuffing rod, tack lifters. The following tools are desirable: sinuous spring cutter and drum; sinuous spring end bender; sinuous spring reel and bracket; paint spraying outfit.

Materials and Supplies: (suggested partial list)

Binding tape, ½ in. blind tacking strips, burlap, EK clips, cotton, back helicals, seat helicals, muslin, 7/8 in. blue barbed nails, offset plates, rubber cement, talcum powder, soapstone, 9-gauge sinuous springs, 11-gauge sinuous springs, stitching twine, upholstery tacks, assorted colors of nylon thread, welt cord, turpentine, shellac, lacquer thinner, alcohol, varnish, lacquer, various colors of paint, wiping rags.

Lessons to be Taught:

This list of lessons was taken from the analysis of objectives and is listed in the nature of general statements of work to be taught rather than in specific titles.

Manipulative Lessons

1. Materials list

2. Procedures of refinishing and upholstering

3. Layout, cutting, forming, shaping, holding, assembly and finishing tools and procedures should include:

   a. Recognize and select
   b. Name correctly
   c. Use properly and safely (To extent needed in repairing and refinishing furniture).

4. Machine and procedures should include:

   a. Name correctly
   b. Use properly and safely (To extent needed in repairing and refinishing furniture)

Related Lessons

This list of lessons was taken from the analysis of objectives and is in the nature of general statements of information needed to be taught rather than specific titles. It should be noted that this list does not include films, discussions and other teaching methods suggested to achieve the behavior changes.

1. Importance of the repairing and refinishing industry.
2. Characteristics of the various materials used in repairing and refinishing furniture.
3. Procedures in furniture repair.
4. Methods of refinishing or upholstering a piece of furniture.
5. Inspection of a refinished or upholstered article.
6. Quality of workmanship and standards in refinished and upholstered articles.

Teaching Aids or Devices:

1. Small scale pieces of furniture to show progressive steps in refinishing and upholstering.

2. Samples of various kind of wood finishes and upholstery materials.

3. Instruction sheets

    a. Preparing furniture for the finish.

    b. Properly applying the finish and final sanding.

    c. Steps in refinishing and upholstering.

Evaluation Techniques:

1. Observation
2. Performance test
3. Class discussions
4. True and false tests
5. Multiple choice tests
6. Assignments and reports

Unit Evaluation:

Evaluation of the unit should be concerned primarily with how well the behavior changes listed in the analysis of the objectives have been accomplished.

Appendix

SUGGESTED TOOL AND EQUIPMENT LIST FOR TYPICAL JUNIOR AND SENIOR HIGH SCHOOL GENERAL SHOPS

Suggested Tool and Equipment List
for Typical Junior and Senior High School General Shops

The following classified list of tools, equipment, and furniture is suggested for successfully teaching of industrial arts in the general shops of Maine.

*Suggested tools and equipment for the junior high school

(The number of tools and pieces of equipment needed will depend on the number of students to be served by the program).

	Layout Tools and Equipment	Size/Cap.
*	Awl, Scratch	
*	Bevel, Sliding T	8"
	Calipers, Hermaphrodite	6"
*	Inside	6"
*	Micrometer	0-1"
	Do	1-2"
*	Outside	4"
	Do	6"
	Do	8"
*	Rule	
*	Dividers, Spring, solid nut	6"
	Wing	8"
*	Gauge, American Standard Wire	
*	Bit	
*	Center	
*	Depth and Angle, comb.	6"
*	Drill point	
	Feeler	
	Fillet and radius	
	Gap, sparkplug	
*	Marking	
	Mortising	
*	Screw pitch	
*	Sheet metal	#21
	Surface	
*	Tap and drill	
	Telescoping (set)	
*	Thickness	
*	United States Standard	
	Indicator, Dial test, Universal	

	Layout Tools and Equipment (Cont.)	Size/Cap.
	Level, Aluminum	24"
	Mason's	
	Plumb bob	
*	Punch, Center	3/8" x 5"
	Chassis	½, 3/4, 7/8, 1, 1 1/8
*	Hollow tinners	5/8"
	Do	3/4"
	Do	7/8"
	Do	1"
*	Pin	1/8"
*	Prick	3/8" x 5"
*	Rotary head	
*	Solid	1/8"
*	Rule, Circumference	36"
*	Push-pull	6'
	Shrink-rule, 1/8" shrink	24"
	Steel, bench	12"
	Steel, flexible	6"
*	Wood, bench	12"
	Do	24"
*	Stamps, Steel	
*	Scriber	
*	Square, Combination	
*	Combination set	12"
	Solid	3"
*	Steel	24"
	Do	18"
	Do	12"
*	Try	8"
	Tape	6', 25', 50'
	Trammel points	
	Transit and accessories	
*	V-Block and clamp (set)	

	Planning Equipment	
*	Compasses	6½"
*	Curve, Irregular	
*	Instruments, Drawing, (set)	

Planning Equipment (Cont.)	Size/Cap.
Machines, Drafting	
* Scale, Architect	12"
* Triangle, 30-60	10"
45-45	6"
* T-square	24"
* Tables, drawing	

CUTTING TOOLS

Drilling, Boring and Reaming	Size/Cap.
* Bit, Auger (set)	4 to 16
Electrician's	3/8" x 24"
* Expansive	7/8" to 3"
Foresner	
Gimlet	
Battery post cleaner	
* Brushes, Wire	
Cleaner, Ring groove	
* Countersink	82°
* Cutter, paper	
Circle	1 3/4" to 8"
* Drill, Automatic hand	
* Drill and Countersink combined, H.S.	4
Do	5
Carbide masonry, set	
* Drill, Twist, carbon (64ths)	1/16 to 1/2"
* Do	1 to 60
Do 1/2" shank	1/2 to 1" (32)
Do, H.S.	A to Z
* Reamer, Adjustable, w/pilot	5/32 to 1 1/16"
Burring	½" rd. shank
Ridge	2 9/16" to 6"
* Screw Plate, N.F. & N.C.	¼" to 1"
* Screw Plate, machine screw set	

Sawing

* Saw, Back	12" 14 tpi

Cutting Tools (Cont.)

	Sawing (Cont.)	Size/Cap.
*	Saw, Compass	12"
*	Coping	16½"
*	Crosscut	
*	Dado	
*	Hack, adj. pistol grip	12"
	close quarter	
*	Hand, panel	24" 10 tpi
*	rip	24" 5½ tpi
*	Jewelers	5"
	Nest of	
*	Miter and box	
*	Rip	
	Turning	
	Shearing	
*	Chisel, Butt	
*	Cape	¼"
*	Cold (set)	
	Do	3/4"
*	Diamond point	¼"
*	Round nose	¼"
	Socket (set)	¼ to 1 (8th)
*	Thonging	
*	Cutter, Bolt	5/16" cap.
*	Diagonal	6"
	End	7"
	Glass	
	Pipe	
	Tubing	1/8 to 1"
*	File, America Swiss (set)	
*	Auger bit	7"
	Contact point	
*	Curve tooth, standard	8 tpi
*	Extra slim taper	4"
	Do	6"
	Do	8"
*	Flat, second cut	8"
	Do, smooth	10"
*	Half round, smooth	10"
	Do , second cut	8"
	Do , bastard	10"
*	Mill, second cut	8"
	Do , second cut	10"
	Do , bastard	10"
*	Needle, (set)	6¼"
*	Round, second cut	8"
	Do, smooth	10"
	Do, bastard	12"

	Shearing (continued)	Size/Cap.
*	File, Square, second cut	8"
	Surform	
	Three-square, smooth	8"
	Gouge, Outside ground (set)	¼ to1" (8ths)
	Inside ground	
	Draw	
	Electrician's pocket	
	Hones, Cylinder	
*	Knife, Sloyd	2 5/8"
*	Trimming	
*	X-Acto (double set)	
*	Skiving	
*	Opener, Can, wall type	
*	Plane, Block	
	Block	
*	Jack	
	Jointer	
	Modelmaker's	
*	Smooth	
	Spokeshave	
	Reamer, Cable terminal	
	Ridge	
*	Scraper, Cabinet	
	Carbon, flexible	
*	Hand	
	Plumber's	
	Putty knife	1¼"
	Wire brush	
	Wood	
*	Shears, Trimmer, straight	8"
*	Snips, Aviation, right	10"
*	Do , left	10"
	Combination	3" cut
	Hawks Bill	3" cut
	Strippers, Wire, straight	
*	Tools, Carving (set)	

	Forming, Assembly and Holding	Size/Cap.
	Adapters, wrench drive	
	Anvil	50 lb.
	Bar, Pry and jimmy	
	Rolling wedge	
	Spreader and removing	
	Wrecking	24"
	Bender, Conduit	
*	Beveler, Edge	
*	Brace, Bit	8"
*	Clamp, Bar	2'
	Do	3'
*	Do	4'
*	Carriage	4"
	Do	6"
*	Do	8"
	Do	10"
*	Handy, #1, #2, #3	6"
	Do	12"
	Quick	
	Saw, filing	
	Valve and tube vulcanizing	
	Brake (set)	
	Compressor, Piston ring, ratchet	2 1/8-5"
	Valve spring	10½" opening
*	Copper, Electric	9/16" tip
*	Soldering (pair)	2 lbs.
*	Creaser, Edge	
	Dolly, Anvil	
	Toe	
	Expander, Piston ring	
	Extractor, Screw (set)	
	Tap (set)	
*	Grips, Vise	7"
	Do	10"
*	Groover, Hand	4
	Do	2

	Forming, Assembly and Holding (Cont.)	Size/Cap.
*	Gun, Soldering	
	Staple	
*	Hammer, ball pein	8 oz.
*	Do	16 oz.
	Do	32 oz.
	Blacksmith's hand	40 oz.
	Brick	
	Combination tire	40 oz.
*	Curved claw nail	13 oz.
	Do	16 oz.
	Dinging	8 oz.
	Lead	
	Planishing	12 oz.
*	Riveting, tinner's	12 oz.
	Setting, tinner's	12 oz.
	Sledge	
	Soft face	8 oz.
*	Handle, File	2
*	Do	3
	Do	4
	Soldering copper	7
*	Handscrews, Adjustable	5/0 4"
*	Do	3/0 6"
*	Do	0 8"
	Do	1 10"
	Hoist, Chain, engine	
	Chain, differential	1 ton
	Inserter, Magnetic, key	
	Iron, Tire, straight	
	Do , curved	
	Jack, Hydraulic	2 ton
	House	
*	Jig, Metal, bending	
	Ladder, Step	6'
*	Ladle, Melting, bottom pour	5"
	Lifter, Valve, overhead	
	Valve, screw type	

Forming, Assembly and Holding (Cont.)

		Size/Cap.
		2½-3 x 5"
	Mallet, Carpenter's	8 oz.
*	Plastic, soft-face	2" dia. 10 oz.
*	Raw-hide	
		1/32
*	Nailset	2/32
*	Do	3/32
	Do	
	Pans, Parts	
*	Plate, Bench (stake holder) (if not furnished with bench)	8" x 30"
*	Pliers, Adjustable offset	
	Adjustable locking	
	Brake spring	
	Curved needle	
*	Combination	
*	Diagonal cutting	
	End cutting resistor	
	Hose clamp	
	Lock ring	6"
*	Long chain nose, side cut	
*	Needlenose	6"
*	Roundnose	6"
	Short chain nose	8"
*	Side cutting	6"
	Do	8"
	Slip joint, heavy duty	10"
	Do	
	Snap ring	9½"
	Water pump	
	Puller, Battery terminal	spread 5½"
	Gear, auto grip	spread 8"
	Do	
	Fuse	
	Hub, universal 3 arm	
	Nail	
	Rake, garden	
		3
*	Rivet set	6
*	Do	7
*	Do	
*	Screwdriver, Stubby	4"
*	Do	6"
*	Do	8"
*	Do	10"
*	Do	
	Do, close quarter	

	Forming, Assembly and Holding (Cont.)	Size/Cap.
	Screwdriver (Cont.)	
	, close quarter	
*	, Phillips 1	
*	, Phillips 2	
*	, Phillips 3	
	, square blade	8"
	, thin blade	6"
	Do	10"
*	Screwdriver, Bit	3/8"
	Clutch head (set)	5/32, ¼, 5/16
*	Offset	
	Do	
	Pocket	
	Set, Chalking iron	
	Shovel, Hand	
	Tamper	
	Threader, Ratchet pipe	
	Tongs, Gad	
	Tool, Brake adjusting	
	Electrician's fishing	
	Flaring (set)	
	Gapping	
	Jointing	
	Modeling	
	Oil filter removing	
	Valve fishing	
	Valve lapping	
	Valve core removing	
	Trowels, cement (various sizes)	
	Tweezers, Soldering	
	Unit, Tire servicing	
*	Vise, Drill press	
*	Machinist	3½"
*	Utility	
*	Woodworkers, rapid acting	4 x 7

	Forming, Assembly and Holding (Cont.)	Size/Cap.
*	Wrench, Adjustable, alloy	4"
*	Do	6"
*	Do	8"
	Do	10"
*	Allen, socket set	
*	Bicycle spoke	
*	Box-end (set of 6)	
*	Combination (set of 6)	
	Deep socket (set)	
	Drain plug	
*	Ignition, combination midget, 8 pces	
	Impact	
	Monkey	
	Nut driver (set)	
	Offset	
*	Open End (set)	
	Pipe	8"
	Ratchet	
	Regular socket	
	Rim	
	Socket (set of 45)	
	Tap, "T" handle	
	Tappet (set of 6)	
	Torque	0 to 150 ft.
	Universal socket, universal joint	
	"Forming Assemblies and Holding Tools"	
*	Seamer-Hand	
*	Stake, Beakhorn	
*	Bevel-edge Square	
*	Blowhorn	
	Needlecase	

	Machines and Heating Equipment	Size/Cap.
	Brake, adjusting and repairing equipment	
*	Brake, Box-pan	24" width, 16 ga. cap. mild steel
*	Buffer	
	Camera, Offset	
*	Collector, Dust	
	Compressor, Air	1/2 h.p. motor, single ph., 110 v. A. C. 1 cyl., 30 gal. tank
*	Cutter, Paper	

Machines and Heating Equipment (Continued)	Size/Cap.
Crane, engine lifting	
Equipment, Lubrication	
* Former, Slip-roll	30"
* Furnace, Bench combination, gas with melting pot	
Heat treating	
* Melting, w/blower, 3 crucibles	
Grinder, Valve & seat	
* Grinder, Tool	½ h.p. motor, 60 cycle, single ph., 3450 rpm, 2 - 7" Alum. Oxide wheels #'s 1267 and 238-815, waterpot, twin light safety shields, 4 lamp bulbs, wheel guards, tool rests, and pedestal
* Jointer	8" ½ h.p. motor, 220/440 3 ph. A.C. 1725 rpm w/manual starter, motor pulley, V-pulley, 3 h.s. steel knives, 2-way tilting fence w/dual control, arbor pulley, front safety knife guard, cast iron stand.
* Lathe, Metalworking	10" 10" bench, 3' or 3½' bed, quick-change, horizontal drive, countershaft w/power cross feed, ½ h.p. motor, 110/220 single ph., A.C.
Accessories:	Chuck, Independent, 6" w/wrench Universal, 5" w/wrench Jacobs w/arbor, ½" cap. #2 M.T.
	Dog (set of 6--3/8 to 1½)
	Knurling tool, revolving head
	Motor control, Drum type, F & R
	Tool Holder, Boring Cut off, rt. hand Left hand Right hand Straight

Machines and Heating Equipment (continued)	Size/Cap.
Lathe, Metalworking - Accessories (cont.)	Bench, angle steel, 26 x 60 x 29 3/16"
* Lathe, Woodworking	12", 37" between centers, 57" O.A., 4-speed, bench, pulleys, ½ h.p. motor, 115/230 single ph., A.C. switch rod
Machine, Print reproduction	
Vertical milling	
Combination sheet metal rotary	
Maker, Plate	
Outfit, Paint spraying	
* Oven, Heating	
* Planer, Surface	12" x 5" Safety type ball bearing cutterhead w/3 knives, 2 groove cutter head pulley, belt guards, floor stand w/motor base, 2 h.p. motor, 3 ph., w/manual switch
Press, Arbor	
* Drill	14" Belt guard, pivoting motor mounting plate, built in depth gauge, depth stop, motor pulley, V-belt, ½" Jacobs chuck w/key
Press, Cylinder	
Offset	
* Platen	
Proof	
* Plastic	
Router, Shaper	3/4 h.p. motor, base, chuck, sub-base
* Saw, Circular	10" Guard, splitter, extension wings, micro-set rip fence, combination blade, miter gauge, front graduated guide bar, rear guide bar, motor pulley, set/3 matched V belts, 2 h.p. motor, 3 ph. w/manual starter
* Saw, Band, wood cutting	14"

Machines and Heating Equipment (Continued)	Size/Cap.
Saw, Band (Continued)	Wheel guards, arbor pulley, wood cutting blade, cast iron stand, belt guard, V belt and motor pulley, ½ h.p. motor, 3 ph., 22/440, 60 cycle, A.C., 1725 rpm, manual starter size 0, across the-line type for motor.
Saw, Power hack	Bench model w/o motor
Saw, Radial arm	9"or 10"
* Saw, Scroll	24" Stand, 4-step cone pulley, 4-step motor pulley, V-belt, belt and pulley guard, 1 saber and scroll blades.
Stands, Auto Engine	
Stone, Imposing	
Tank, Cleaning (auto)	
Torch, blow	
* Welder, Electric	A.C. 180 Amps w/arc booster
Oxy-acetylene	Pipeliner torch set
* Spot	
PORTABLE MACHINES	
* Drill, electric, standard duty	1/4"
Do Do	1/2"
Grinder, Disc polisher	
Sander, belt, heavy duty	3" x 24"
* finishing (oscillating)	
Saw, Electric skill Electric saber	

Testing and/or Measuring Equipment

Alignment set, magnetic, wheel

Balancing equipment, wheel

Charger, battery

Freezometer, anti-freeze

Galvanometer

Gauge, Air hose, heavy duty
* Tire pressure

Generator, Signal

Hydrometer, Battery

Lamp, Series test

Jig, Aligning, rods

Magnets, horseshoe and bar

* Meter, Ammeter, multiscale, A.C.
* Panel, A.C. 0-30 v.
* Do 0-250v.
* Milliammeter
* True Vacuum Tube Volt-Ohm-Milliammeter and Capacitance
Vacuum Tube Voltohmmeter
* Voltmeter
Watt-hour, single phase

Oscilloscope, 5" megacycle high sensitivity

Tester, All purpose electrical
Appliance
Armature growler
Battery-starter
Bell-ringer
Cell, voltage
Coil
Compression kit, timing and vacuum
* Continuity
Condenser
Distributor
Headlight
Motor analyzer
Oscilloscope, engine
Regulator, generator
Spark plug and cleaner
Thermostat
Tube, vacuum
* Hardness
Scale, spring tension

Testing and/or Measuring Equipment (Cont.)

Set, carburetor tool

* Supply, power (D.C. 0 - 200 v. ... A.C. 6.3 A.)

* Supply, power (Variable D.C. ... 0 - 40 V.)

* Supply, power (0 - 15 amps ... Variable A.C. supply)

System, Electronic Training (for pupils)

Unit, Lecture Demonstration (panels, accessories, etc. for teacher)

	Furniture	**Size/Cap.**
*	Bench, Woodworking	54 x 64 - 32¼ high
	Locker type, 12 lockers	
*	Demonstration	
	Locker type, single station	28½ x 64 x 32¼" high
*	Electronic	48 x 96 x 32¼" high, locker type
*	Arc welder's	36 x 36 x 33½" high
	Gas welder's	Do
*	Ceramic	
*	Glue and stain	24 x 60 x 30" high
*	Leather	
*	Molding	24 x 48 x 60" high
*	Plastics	
*	Sheet metal w/plates	40" x 96 x 32" high
*	Power mechanics	
*	Silk screening and bookbinding unit	
*	Cabinet, File, steel 4-drawer w/lock	letter size
*	Storage, steel	36 x 24 x 78" high
*	Type & Accessories	
*	Paper storage	
	Galley	
*	Chair, Instructor's	
*	Desk, Instructor's	26 x 54 x 30" high
	Rack, Drying	
*	Stool, Steel, square seat	14" top x 22" high
	Table, Light	
*	Planning	

	Maintenance Tools and Equipment	**Size/Cap.**
*	Blowtorch, bernz-o-matic	
	Brush, Glue	1/2"
*	Burnisher	

	Maintenance Tools and Equipment (Cont.	Size/Cap.
*	Card, File and brush	
	Do, common	
*	Duster, Counter	
*	Dustpan	
*	Dresser, Wheel	
*	Funnel	8"
*	Gloves, Rubber & leather	
	Gun, Grease	
	Do , hand	23 oz.
	Suction, oil	20 oz.
*	Spray, suede tex	
	Hone, Burnishing	2 11/16 to 4 1/8
	Kit, dovetail	
*	Knives, Putty	
	Measure, Quart	
*	Oiler, Bench, steel	1/2 pt.
	Do	1/3 pt.
	Hydraulic pump	1 pt.
	Spring, automobile	1/3 pt.
*	Oilstone, India-Washita, Combination	
*	Slip, India	
*	Slip, India pocket	
*	Slip, carving tool set , India	
*	Opener, Can and pour spout	
*	Plate, dado insert	
	Scraper, paint	
	Set, Saw	
*	Sweep, Floor, all black horsehair	16"

	Miscellaneous Equipment	Size/Cap.
*	Bellows, Molders	10"
*	Bulb and Sponge	4 oz.

	Miscellaneous Equipment (Cont.)	Size/Cap.
•	Cutters, Spoon and Gate	
•	Sprue	
•	Flask, Wood or steel	10" x 12"
•	Lifter	
•	Rammer, Bench	3½" x 14"
•	Riddle	16"
•	Shovel, molders	
•	Slick and Oval	1"
•	Slick and square	
•	Tongs, Crucible	
•	Trowel, Square & finish	1¼" x 6"
	Band, Tire bead	
	Battery, Storage	6 volts, 3 cell 130 Amp.
	Cables, Booster (set)	8'
	Covers, Fender	
	Creeper, Auto	16" x 36"
	Gun, suction, oil filters	
	Electri-Kit	
	Lamp, Trouble, heavy cord w/lamp protector, 2 outlets	
	Torch, Master w/pencil burner and cylinder	
	Tube, Brake bleeder	
	Strap-Battery Carrier	

Safety and First Aid Equipment	Size/Cap.
• Apron, Chrome leather	24" x 36"
• Curtain	to specifications
• Extinguisher, Fire CO	5 lb.
• Fan, Exhaust	1680 Cu. Ft./Min. 16" Blade
• First Aid Kit, General	
• Gloves, Rubber	
• Welder's, Chrome Leather Gauntlet	
• Goggles, Safety	
• Hose, Flexible Exhaust, metal	3" x 10'
• Oily Waste Can	Automatic 10 gal.
• Puller, Fuse	
• Shield, Face	
Stand, Jack (pair)	2 ton

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